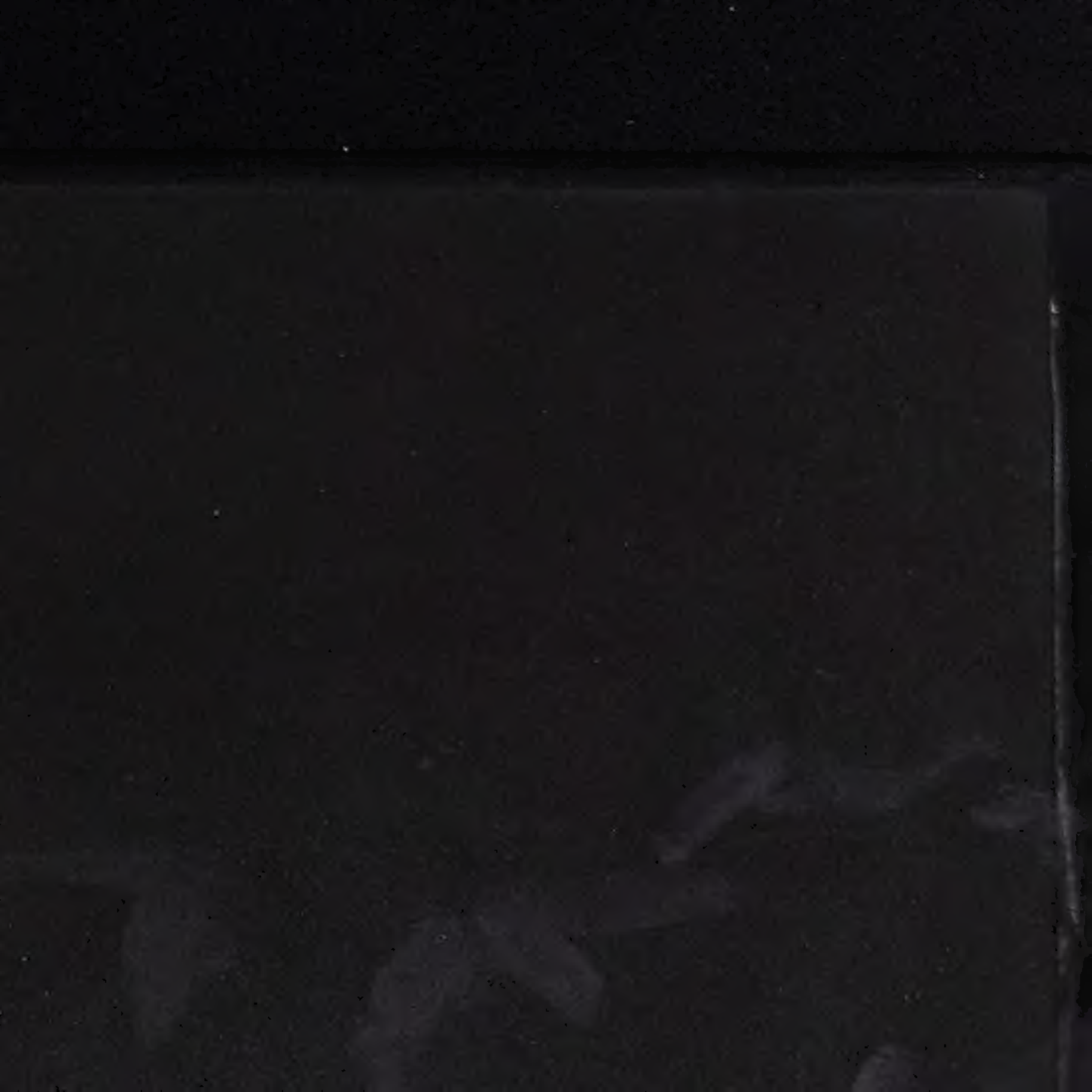

UPC-32
UPC-12

OPERATION MANUAL

PPSC PART NO. 133620

THIS MANUAL ASSIGNED TO:

CONTROLLER MODEL _____ S/N _____

POWER SOURCE MODEL _____ S/N _____

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SECOND EDITION

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SECTION 1

GENERAL

1 GENERAL

This manual is written to provide the information required to use the Universal Programmer / Controller (UPC) and System Control Unit (SCU). This manual is an Operations Manual. Installation, operation and calibration are the subjects covered by this manual.

This manual is to be used with the UPC32, UPC12, UPC-30, UPC-10 and the SCU (System Control Unit) containing these models.

1.1 USING THIS MANUAL

It is very important that the user reads section 4 (Front Panel Operation) prior to using this equipment. A thorough understanding of this section is required to properly operate this equipment. If the user intends on using the UPC under REMOTE CONTROL via the GPIB, the user should also read section 5 (GPIB Operation). If the optional RS-232 SERIAL interface is to be used, read section 10 (RS-232 SERIAL Interface option) then section 5.

Be aware of the **"HOW TO"** section following the Table of Contents as it may be helpful for the first time user as well as the experienced user. Also very helpful is the **"QUICK OVERVIEW"** section 4.0.1 and **"QUICKLY PUTTING THE UNIT TO USE"** section 4.0.2. REMOTE INTERFACE users will find the **"REMOTE INTERFACE FUNCTION REFERENCE"** to be helpful also.

1.2 SAFETY NOTICES

The UPC-Series of equipment controls the AMX/ASX Series of equipment which is capable of transferring very large amounts of electrical energy very quickly. This basic quality is fundamental to a high-performance power source. The warnings and cautions listed below should be observed at all times.

WARNINGS are conditions which are hazardous to user personnel. All warnings throughout this manual will be formatted as shown below. A condition which is hazardous to both personnel and equipment will be issued as a warning.

CAUTION statements indicate a dangerous situation which may damage the equipment but is not a threat to life or limb. Cautions will assume the format shown opposite. All cautions should be rigorously observed

* * * **WARNING** * * *

• THIS EQUIPMENT CONTAINS HIGH-ENERGY, LOW-IMPEDANCE CIRCUITS !!
LETHAL POTENTIALS ARE CONTAINED WITHIN THE SYSTEM.

•CARE MUST BE EXERCISED WHEN INSTALLING OR CALIBRATING THIS EQUIPMENT IN ORDER TO PREVENT SERIOUS OPERATOR INJURY OR EQUIPMENT DAMAGE.

• OUTPUT VOLTAGE RESPONDS ***INSTANTLY*** WHEN THE POSITION OF THE OUTPUT POWER SWITCH IS CHANGED.

LOAD MAY BE DAMAGED DUE TO EXCESSIVE OUTPUT VOLTAGE.

- ALWAYS MAKE SURE THAT THE OUTPUT ON/OFF SWITCH IS IN THE **OFF** POSITION BEFORE CHANGING THE OUTPUT COUPLING MODE.

* * * **WARNING** * * *

1.2 SAFETY NOTICES (cont)

* * * WARNING * * *

• OBSERVE THE FOLLOWING WHEN INSTALLATION OR CALIBRATION IS REQUIRED:

1)REMOVE ALL JEWELRY FROM HANDS, ARMS AND NECK WHEN SERVICING THIS EQUIPMENT. THIS PREVENTS THE POSSIBILITY OF SHORTING THROUGH THE JEWELRY AND CAUSING BURNS TO OR ELECTROCUTION OF THE OPERATOR.

2)**WEAR SAFETY GLASSES** WHEN SERVICING THIS EQUIPMENT TO PREVENT EYE INJURY DUE TO FLYING PARTICLES CAUSED BY ACCIDENTAL SHORT CIRCUIT CONDITIONS.

3)DO NOT REMOVE ANY PANELS OR COVERS WITHOUT FIRST OPENING **ALL** CIRCUIT BREAKERS AND THEN REMOVING THE INPUT SERVICE.

4)SERVICING SHOULD BE REFERRED TO PERSONNEL AUTHORIZED BY THE FACTORY TO SERVICE THIS EQUIPMENT.

* * * WARNING * * *

- - - CAUTION - - -

READ SECTIONS 3, 4 AND 7 OF THIS MANUAL BEFORE INSTALLING, CALIBRATING OR OPERATING THIS EQUIPMENT.

- - - CAUTION - - -

1.3 GENERAL PRODUCT DESCRIPTION

1.3.1 UPC DESCRIPTION

The UPC is a highly versatile single, two or three phase signal generator. It is designed to directly plug into Pacific Power Source Corporation's AMX/ASX Series Power Source or a System Control Unit.

The signal generation section produces the three output signals representing ϕA, ϕB and ϕC of the power source.

Each signal can be any of the first 16 waveforms stored in memory. The first of these 16 waveforms is a sine wave and cannot be altered, the other 15 waveforms can be altered by the user to produce any arbitrary function of time.

The phase relation between the three output vectors may be varied.

The voltage amplitude of each vector may be varied together or independently.

The frequency of the three output vectors is controllable from 20.00 to 5000 Hz.

The signal generations section produces either steady-state signals - a base set of volts, frequency, waveforms and phase angle - or dynamic signals in which parameters change with time. Dynamically the signal generator can produce transient events lasting from microseconds to many hours.

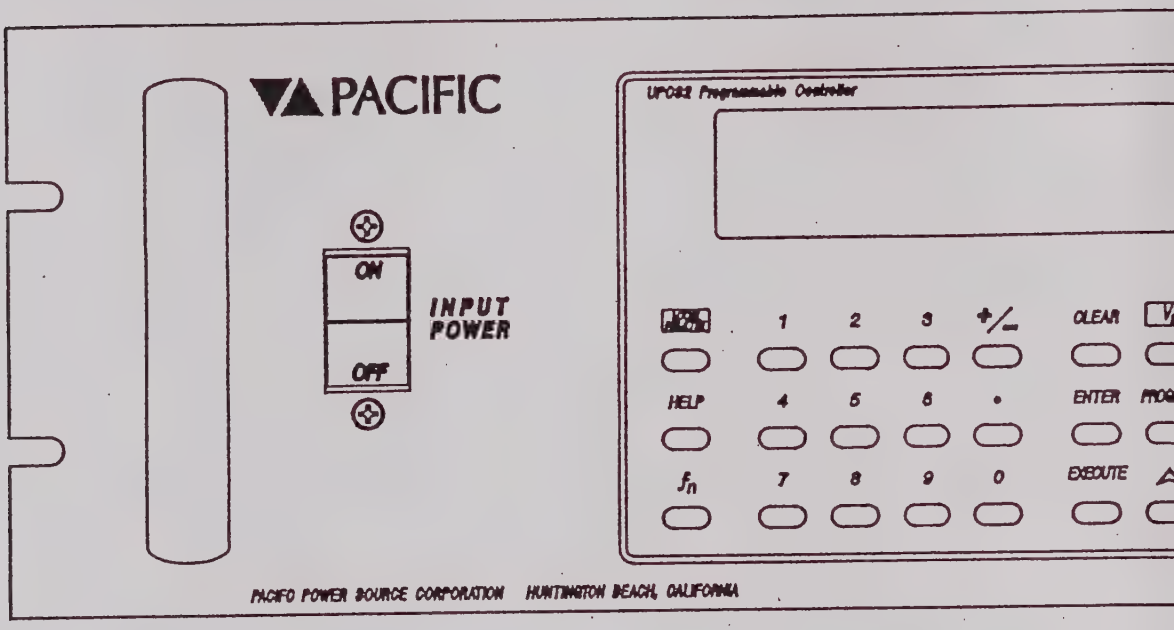
The Display section of the UPC utilizes a 160 character Backlit LCD display, which alternately meters operating parameters, or displays alpha-numeric text interactively with the operator to prompt and assist in loading programs or editing. On completion of any programming or editing function, the display automatically reverts to the metering display currently selected.

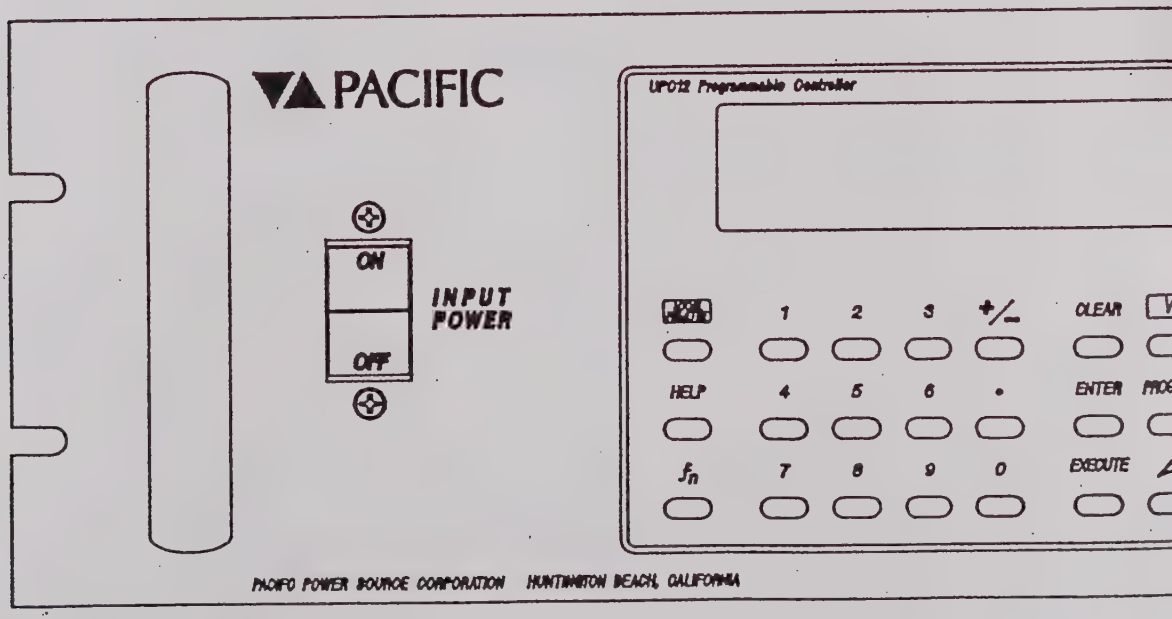
Full parameter metering is provided by the UPC. Output volts (line-to-line and line-to-neutral), current (true RMS, peak and crest factor), KVA, Kw and Power Factor. Frequency is indicated. Internal or External voltage metering is user selectable. Internal metering causes the output voltage to be metered at a point prior to the Output Contactor. This allows the output voltage to be checked prior to applying power to the load. External metering allows the output voltage to monitored at a remote point outside of the power source. With CSC enabled (see below), external sense can be used to maintain an accurate voltage at a remote point, compensating for line voltage drops.

Externally referenced Metering calibration is simplified by the aid of internal software that allows external measurements to entered into the front panel or Remote Interface. Correction values are then calculated and stored in the UPCs memory.

CSC (Continuous Self Calibration) is also provided. This feature allows the user to compensate for real losses due to output transformers and distribution lines by maintaining an accurate COMMAND (program) voltage at the metered sense point. CSC may be enabled or disabled at the user's discretion.

SCU–UPC32





SCU–UPC12

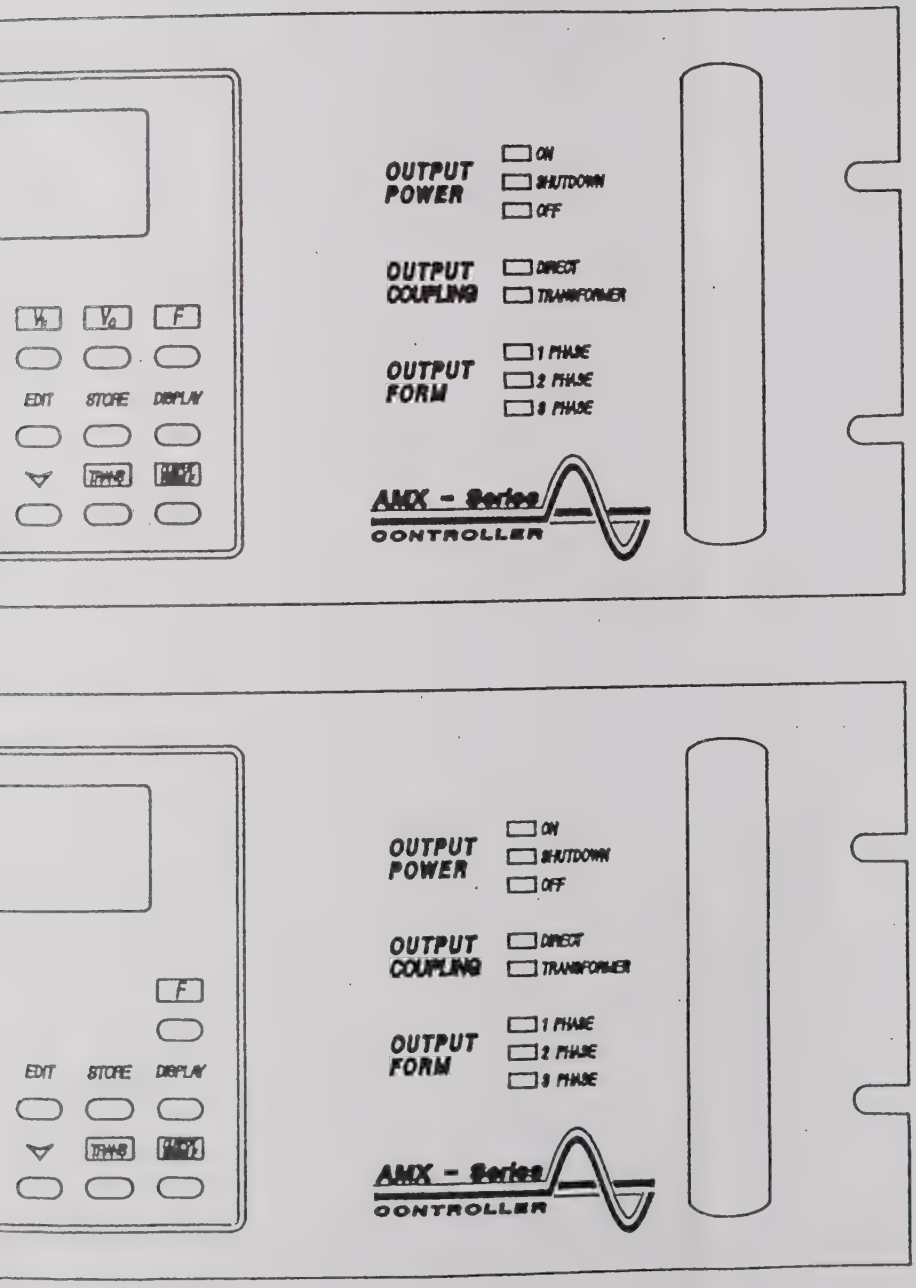


FIGURE 1.3 SCU–UPC32, SCU–UPC12

1.3.1 UPC DESCRIPTION (cont)

The UPC is designed for use with the AMX/ASX Series AC Power Source. It is interchangeable with other UPC/UMC Series controllers.

A power source output transformer ratio may be programmed into the UPC for voltages outside of the power source direct coupled range.

Programmable Current limit is provided.

Auxiliary and Amplitude Modulation inputs are provided.

The user may store 99 user programs in battery backed up RAM. Each program may contain steady-state and transient parameters. There are also pre-stored programs that allow the user to generate MIL-STD 704D transients.

A unique feature available within the UPC is TRANSITION TIME. If Transition time is set to non-zero value, and a new program is executed, or changes are made in MANUAL MODE (or in REMOTE CONTROL), it will take this long for the UPC to transition from the current voltage and frequency to the new voltages and frequency. This feature may be used when it is undesirable to cause abrupt changes to the output power signal. This feature does not affect transient operation. Transition time may be set from 0 to 300 seconds in 200 uS steps.

Waveform analysis functions are optionally provided to report both magnitude and phase angle of each harmonic for metered voltage and current waveforms (below 500 Hz). THD, ODD and EVEN harmonic distortion measurement data is also reported.

Programmable Output Impedance is an option that allows the user to compensate for dynamic losses due to output transformers and distribution lines by effectively controlling the output impedance of the power source. This feature is also known as Current Compensation.
The UPC may be used in Local (front panel) or Remote (GPIB or RS-232 SERIAL) control.

The GPIB interface is IEEE-488.1, IEEE-488.2 and SCPI compatible.

An RS-232 serial port interface is optionally available as an alternative to the IEEE-488 REMOTE interface. It is IEEE-488.2 and SCPI compatible.

Metered voltage and current waveform data (digitized waveforms) can be retrieved via the REMOTE interface.

1.3.2 CONTROLLER MODELS

The term 'UPC' is derived from Universal Programmer / Controller. The UPC-32 is a 3ϕ signal generator designed to plug in to any PACIFIC AMX/ASX Series chassis which is 1ϕ / 2ϕ / 3ϕ convertible.

The UPC-12 is identical in characteristics to the UPC-32, except that it produces only one output signal. It is designed to plug in to any PACIFIC single-phase-only AMX or ASX model power source.

The assembly number for the UPC32 is 133600.
The assembly number for the UPC12 is 133700.

The UPC-30 and the UPC-10 are identical in characteristics to the UPC-32 and UPC-12, except that they have blank front panels and are controlled by a REMOTE INTERFACE (GPIB or RS-232) only.

1.3.3 SCU DESCRIPTION

The System Control Unit is a 19 inch wide, 5.25 inch high, 7 inch deep rack mounted box with a power supply, to hold a UPC. This allows the UPC to be remotely located from the power source.

The term 'SCU' is derived from System Control Unit. It is a small chassis with internal power supply and cabling interface which supports any one of the controllers described above. Its purpose is to provide a suitable housing for the controller when the application requires a controller remotely located from the power source. For example, the complete designator for a "stand-alone" controller housing a UPC-32 is SCU/UPC-32. Such a unit will drive some of the larger PACIFIC AMX or ASX power sources through their rear panel interface. A typical usage might be to locate the power source at the base of an instrument rack, with the controller installed in an upper slot at a more convenient eye level.

The assembly number for the SCU is 133000.

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SECTION 2

SPECIFICATIONS

2 SPECIFICATIONS

This section states the specifications of both Output Control and Metering capabilities of the UPC.

Ambient conditions are as follows.

Temperature	0-50° C.
Humidity	0-95% R.H Non-Condensing.

2.1 CONTROL SPECIFICATIONS

2.1.1 FREQUENCY CONTROL SPECIFICATIONS

The UPC output frequency is variable from 20 to 5000 Hz. Internally, there are 3 frequency ranges, each with a different resolution. The user need NOT be concerned with changing these ranges as the UPC performs autoranging based on the selected frequency.

RANGE	RESOLUTION
20.00 - 99.99 Hz	0.01 Hz
100.0 - 999.9 Hz	0.1 Hz
1000 - 5000 Hz	1 Hz

Accuracy is ± 0.01 % of full scale over the full range of ambient conditions.

A unique feature available within the UPC is TRANSITION TIME. If Transition time is set to non-zero value, and a new program is executed, or changes are made in MANUAL MODE (or in REMOTE CONTROL), it will take this long for the UPC to transition from the current voltage and frequency to the new voltages and frequency. This feature may be used when it is undesirable to cause abrupt changes to the output power signal. This feature does not affect transient operation. Transition time may be set from 0 to 300 seconds in 200 uS steps.

2.1.2 VOLTAGE CONTROL SPECIFICATIONS

The voltage amplitude of each vector can be varied independently. There are two coupling modes selectable (through stored programs) within the UPC.

1) DIRECT COUPLING MODE range is 0 to 150 VAC rms with a resolution of 0.1 volts. This mode is internally fixed with an effective TRANSFORMER RATIO of 1.0.

2) TRANSFORMER COUPLED MODE range is 0 to (136.5 x XFMR RATIO) VAC rms with a resolution dependant upon the TRANSFORMER RATIO as described below. This allows for a possible output voltage of up to 341 VAC rms using an output TRANSFORMER RATIO of 2.5.

The voltage range available at any given time is automatically calculated by the UPC. The power source is automatically driven with the correct amplitude signal and does NOT require the user to perform mathematical calculations to determine output voltage dependant upon a transformer ratio.

The UPC allows the Power Source to use any output TRANSFORMER RATIO from 0.1 to 5.11. Voltage resolution for TRANSFORMER COUPLED MODE is as follows.

XFMR RATIO	Vresolution
.1 - 1.0	0.1 VAC rms
1.1 - 2.5	0.5 VAC rms

The ratio is set by the TRANSFORMER RATIO SWITCH on the UPC METERING PCB. See section 3.4.1. The power source must contain an output transformer configured with the same ratio as set by this switch.

TRANSFORMER RATIOs greater than 1.0 are step-up types.
TRANSFORMER RATIOs less than 1.0 are step-down types.

Accuracy is ± 0.5% of full scale over the full range of ambient conditions with CSC disabled. Accuracy is ± 0.05% of the program voltage referenced to the internal voltmeter with CSC enabled.

NOTE: The above voltages are power source output voltages. The UPC actually produces an RMS voltage equal to (Power source output Vrms / 25 / TRANSFORMER RATIO). The SCU provides this type of low voltage output to be fed into a power source.

NOTE: TRANSFORMER RATIOs are implied as a ratio to one, eg; a ratio of 2.5 is implied as a ratio of 2.5:1 .

A unique feature available within the UPC is TRANSITION TIME. If Transition time is set to non-zero value, and a new program is executed, or changes are made in MANUAL MODE (or in REMOTE CONTROL), it will take this long for the UPC to transition from the current voltage and frequency to the new voltages and frequency. This feature may be used when it is undesirable to cause abrupt changes to the output power signal. This feature does not affect transient operation. Transition time may be set from 0 to 300 seconds in 200 uS steps.

2.1.2.1 CSC (CONTINUOUS SELF CALIBRATION) SPECIFICATIONS

The UPC includes a user selectable Continuous Self Calibration function. When selected, this function maintains a constant output voltage at the metering point based on the metered voltage at that point. Therefore, accurate calibration of the metering functions is essential for CSC to operate accurately. When INT SENSE is chosen, CSC attempts to precisely maintain accurate COMMAND (program) voltage at the input side of the Output Contactor of the power source. When the load voltage drops due to distribution losses, CSC can be effectively used to maintain COMMAND (program) voltage very precisely at the load by selecting EXT sense with CSC enabled.

Basic properties of the CSC function are:

1. Voltage level held to $\pm$ 0.05% of the program voltage referenced to the internal voltmeter with CSC enabled.

2. Response time varies anywhere from 1 ms. to 1 second and only responds while the UPC is metering, not while in Program Edit or Setup mode.

3. CSC operates independent of selected waveform, does not increase distortion and is stable into any PF load.

4. Automatically switches between internal and remote voltage control as the metering function is switched between INT and EXT.

5. The CSC circuit does NOT function during transients.

6. CSC will only correct the Output Voltage by +/- 10%. If the sense voltage is beyond +/- 10% of the COMMAND voltage, CSC will become disabled until the Output Voltage is back within +/- 10% of the COMMAND voltage. Each phase operates independently.

2.1.3 CURRENT LIMIT CONTROL SPECIFICATIONS

Current limit is provided for all phases through a single RMS current value. The range of this value is equal to the ammeter range set by the AMPS TO VOLTS RATIO. See section 2.2.2. This function is an average responding, RMS programmed function, with a response time of approx. 100-200 mS.

Range is = Amps to Volts ratio x 10 (divided by 3 if 3ϕ power form is used, and divide by 1.5 for single phase model power sources containing 2 power amps).

Resolution is Range/2000 (.05%).

Accuracy is ± 1% of full scale over the full range of ambient conditions.

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2.1.4 WAVEFORM CONTROL SPECIFICATIONS

There may be a potential of 99 pre-stored waveforms stored in the UPC EPROM. Each output phase is generated by one of 16 waveforms stored in RAM. Each Output phase may be independently generated by separate waveforms by creating a Stored program and specifying a different waveform number for each phase within that program.

Waveform 1 is always a Sine wave. Waveforms 2-16 are editable. Waveforms 17-99 are stored in the CPU EPROM. Waveforms 2-16 may be selectively edited, or loaded from stored waveforms (17-99) in the CPU EPROM (by copying). Note that this gives the user the ability to create almost any waveform with the UPC such as sub-cycle transients. See section 4.4.2.2 for creating a cycle-based transient that performs waveform substitution for 1 cycle.

When the ERASE ALL RAM AND RESET CPU function is selected, waveforms 17 - 32 are copied (as defaults) to waveforms 1-16 respectively as shown in the following table.

EDITABLE WAVEFORM #	EPROM WAVEFORM #	DESCRIPTION
1	17	SINE WAVE
2	18	TRIANGLE - 12.7% THD
3	19	SQUARE - 38.6% THD
4	20	PULSE (30° WIDTH) - 153% Avg. THD
5	21	FLAT TOP - 5% THD (PK:RMS = 1.309)
6	22	FLAT TOP - 6% THD (PK:RMS = 1.295)
7	23	FLAT TOP - 7% THD (PK:RMS = 1.282)
8	24	FLAT TOP - 8% THD (PK:RMS = 1.269)
9	25	FLAT TOP - 9% THD (PK:RMS = 1.257)
10	26	FLAT TOP - 10% THD (PK:RMS = 1.246)
11	27	FLAT TOP - 11% THD (PK:RMS = 1.235)
12	28	FLAT TOP - 12% THD (PK:RMS = 1.225)
13	29	*IEC 77A CLASS 1 - 12.6% THD
14	30	*IEC 77A CLASS 2 - 14.4% THD
15	31	SINE WAVE
16	32	SINE WAVE
--	33-99	UNDEFINED

*NOTE: IEC 77A (Secretariat) 99 Draft (Sept. 1993)

NOTE: THD is measured as RMS THD with a Distortion Analyzer unless noted above.

The previously listed waveforms are created using this formula:

$$\text{WAVEFORM} = \Sigma\ \alpha_n \sin(nw\tau + \delta)$$

As an example, the above formula may use values from the following tables.

WAVEFORM #1 SINE WAVE

n	αn %	δ
1.0	100.0	0.0

THD=0%

WAVEFORM #13 - IEC 77A CLASS 1

n	αn %	δ
1	100	0
3	8	0
5	9	0
7	5	0
11	2	0
13	2	0

THD = 12.6%

WAVEFORM #14 - IEC 77A CLASS 2

n	αn %	δ
1	100	0
3	6	0
5	8	0
7	7	0
11	7	0
13	6	0

THD = 14.4%

2.1.5 OUTPUT POWER FORM CONTROL SPECIFICATIONS

The UPC-32 may create single, two or three phase waveforms with ϕB and ϕC at any phase angle referenced to phase A.

The UPC-12 generates only one output vector. When used in an AMX or ASX Power Source, it may generate one and two phase output.

When two phase output form is selected, the hardware in the Power Source causes the ϕB signal to be 180° out of phase with the ϕA signal. The user may program 240 VAC with a result of 120 VAC from ϕA to neutral and 120 VAC from ϕB to neutral and 240 VAC from ϕA to ϕB.

2.1.6 PHASE ANGLE CONTROL SPECIFICATIONS

The phase angle displacement may be programmed for phases B and C. The phase relation between the three output vectors can be controlled from 0 to 359 deg. in 1 deg. increments.

Range is 0 - 359°
Resolution is ± 1°
Accuracy is ± 0.5°

2.1.7 WAVEFORM SYNTHESIS SPECIFICATIONS

HARMONIC RANGE is 2 through 51.

MAGNITUDE

Each magnitude percentage is referenced to the fundamental which is always defined as having a magnitude of 100%.

Range is 0% to 999%
Resolution is .1%
Accuracy is +/- 1% referenced to the fundamental

PHASE ANGLE

Phase angles based on a Sine series are accepted.

Range is 0° to 359.9°
Resolution is .1°
Accuracy is +/- 2% F.S.

Calculation time is approx. 45 secs + 10 secs for each non-zero magnitude.

NOTE: The waveform is synthesized using a sine series with coefficients expressed in polar format, ie. that is magnitude and phase angle.

2.2 METERING SPECIFICATIONS

2.2.1 VOLTMETER SPECIFICATIONS

Three voltmeter inputs are provided, one per phase. Both Line to Neutral (VLN) and Line to Line (VLL) voltages are metered.

Range and resolution of the current metering circuit is as follows.

Vrms Meter range is 354 VLN, 708 VLL A.C.

DISPLAY resolution is 0.1 VAC rms. The Remote interface may provide up to 3 digits of precision (number of digits to the right of the decimal point).

Accuracy is ± 0.25% of reading + 0.1% F.S. @ 25° C from 50-500 Hz.
Accuracy over 20-5000 Hz. is ± 0.5% F.S. @ 25° to 50° C.

NOTE: Some load voltage may be displayed with NO LOAD attached due to the sensitivity of the metering circuits.

NOTE: Power source voltmeter scaling is internally fixed at 50:1, eg;
50 VAC at load = 1 VAC input to UPC = 50 VAC displayed.

2.2.2 AMMETER SPECIFICATIONS

Three ammeter inputs are provided, one per phase. Both Peak and RMS values are displayed. Current Crest Factor is also displayed which is the ratio of Peak current to RMS current.

Range and resolution of the current metering circuit is as follows.

I Meter range = Amps to Volts ratio x 10 (divided by 3 if 3ϕ form is used)

DISPLAY range and resolution is .01 Amps rms or Peak. The Remote interface may provide 3 digits of precision (number of digits to the right of the decimal point).

Accuracy is ± 0.25% of reading + 0.1% F.S. @ 25° C from 50-500 Hz.
Accuracy over 20-5000 Hz. is ± 0.5% F.S. @ 25° to 50° C.

NOTE: The AMPS TO VOLTS RATIO dip-switch is located on the UPC METERING PCB. See section 3.4.2. This ratio may be displayed with the UPC STATUS display (*fn*,3,3)

NOTE: Some load current may be displayed with NO LOAD attached due to the sensitivity of the metering circuits.

Current crest factor is displayed as Ipk/Irms. Display range and resolution is XX.XXX The Remote interface may provide 3 digits of precision (number of digits to the right of the decimal point).

2.2.3 kVA METER SPECIFICATIONS

kVA metering is provided using the metered volts and amps values multiplied by each other. Display range and resolution is XXX.XXX kVA. The Remote interface may provide 3 digits of precision (number of digits to the right of the decimal point).

Accuracy is ± 1% of full scale over the full range of ambient conditions.

2.2.4 KILOWATT METER SPECIFICATIONS

True kilowatt metering is provided using the voltmeter and ammeter inputs. Display range and resolution is XXX.XXX kW. The Remote interface may provide 3 digits of precision (number of digits to the right of the decimal point).

Accuracy is ± 1% of full scale over the full range of ambient conditions.

2.2.5 POWER FACTOR METER SPECIFICATIONS

Power factor is displayed as kW / kVA. Display range and resolution is X.XXX . The Remote interface may provide 3 digits of precision (number of digits to the right of the decimal point).

Accuracy is ± 1% of full scale over the full range of ambient conditions.

2.2.6 FREQUENCY DISPLAY SPECIFICATIONS

The programmed frequency is displayed as an indicator only. Internally, there are 3 frequency ranges, each with a different resolution. The user need NOT be concerned with changing these ranges as the UPC performs autoranging based on the selected frequency.

Range 20.00 - 5000 Hz.

Resolution is .01 Hz from 10.00 to 99.99 Hz.
Resolution is 0.1 Hz from 100.0 to 999.9 Hz.
Resolution is 1 Hz from 1000 to 5000 Hz.

Accuracy is ± 0.01% of full scale over the full range of ambient conditions.

2.2.7 WAVEFORM ANALYSIS

GENERAL

The UPC WAVEFORM ANALYSIS function is an option which derives harmonic components for any of the output voltage or current waveforms. Harmonics are displayed in tabular form on the front panel LCD display or may be queried via the Remote Interface. Harmonics are shown as a sine series with phase angle. Also displayed is Total Harmonic content (THD) and individual sums of even and odd harmonics (EHD & OHD). THD is the RMS of EHD and OHD.

SPECIFICATIONS

These Harmonic analysis functions report both magnitude and phase angle (relative to 0° of voltage) of each harmonic for metered voltage and current waveforms below 500 Hz.

FUNDAMENTAL FREQUENCY RANGE (Fout)	20-500 Hz.
HARMONIC RANGE	2nd - 51st Harmonic.
HARMONIC CONTENT (Magnitude)	
ACCURACY	+/- 1% of Fundamental (see NOTE 1)
RESOLUTION	0.1 %
HARMONIC PHASE ANGLE	(see NOTE 2)
ACCURACY	Fout < 100 Hz. - 2nd-20th: +/- 1° 21st-51st: +/- 2° Fout > = 100 Hz. +/- 8°
RESOLUTION	1° with a range of -180° to +180°.

The harmonic data is reported using a sine series with coefficients expressed in polar format, ie. that is magnitude and phase angle.

Each magnitude percentage is referenced to the fundamental which is always defined as having a magnitude of 100%.

* NOTES:

1. When analyzing load current or voltage, always use as much of the meter range as possible. The specifications given apply to measured waveforms in which the peak values are at least 20% of the meter range. Valid results can be obtained from lower magnitudes, but accuracy of the higher order harmonics will deteriorate rapidly.

2. Phase angle accuracy is a guideline value only. It cannot be precisely stated because it varies greatly with waveform type and magnitude. In general, it is most accurate with quasi-sinusoidal waveforms - and poorest with pulse type waveforms and those containing many discontinuities, when resolving high order harmonics.

2.3 ELECTRICAL INTERFACE

2.3.1 ISOLATION

The UPC contains one isolated power supply for all circuits. The REMOTE interface is **NOT** isolated from the CPU or oscillator sections. The UPC's circuits may float with respect to GND but this is not recommended. In the Power Source, provision is made at one location to tie power supply common to GND. The user may establish their own local ground by removing the link from power supply common and GND.

2.3.2 INPUT POWER

The System Control Unit (SCU) will operate from 115 or 230 VAC, 47 to 440 Hz. Conversion is made by a recessed switch on the back of the SCU. Input protection is a front panel circuit breaker.

2.3.3 ANALOG OUTPUTS

The oscillator waveform (ϕA, ϕB, ϕC) differential outputs are on J3. They are capable of driving full output of ± 10 V_{peak} into a 600 ohm load.

2.3.4 OUTPUT CONTROL

Digital outputs are ± 15 VDC, positive logic.

The UPC sends the following control signals to the power source on J3:

NAME	FUNCTION
3ϕ - CMD	3ϕ output form command.
1ϕ - CMD	1ϕ output form command.
	NOTE: If both 3ϕ and 1ϕ are false, the form is 2ϕ.
CONNECTOR - CMD	Verify UPC is connected to power source. Also drives audible beeper in the power source.
EXT SENSE - CMD	External metering command.
XFMR CPLD - CMD	Transformer coupled output command.
OUTPUT ON -CMD	Close output contactor command.

2.3.5 OUTPUT CONFIRMATIONS

Digital inputs are ± 15 VDC, positive logic.

The power source sends the following control signals to the UPC on J3:

NAME	FUNCTION
CONNECTOR - CONF	Verify UPC is connected to power source.
SHUTDOWN - CONF	Power source shutdown confirmation.
3ϕ ON - CONF	3ϕ output contactor is closed.
1ϕ ON - CONF	1ϕ output contactor is closed.
XFMR CPLD - CONF	Transformer coupled output confirmation.

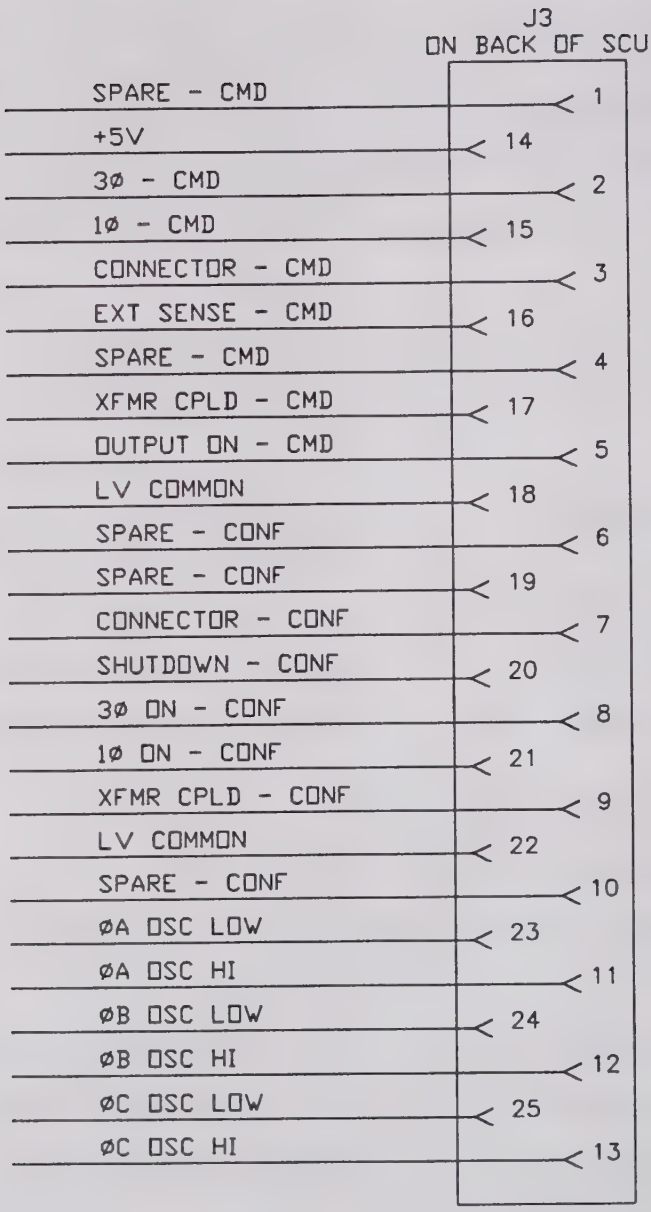

FIGURE 2.3.3 J3 OSC CONTROL

2.3.6 ANALOG INPUTS

Three **Auxiliary Inputs** are provided on J5, one per phase. The Auxiliary Inputs are AC coupled and algebraically summed to the Oscillator signals produced by the UPC. It should be noted that the Auxiliary Inputs can be used as external inputs simply by programming the UPC for 0 VAC output.

Auxiliary Input voltage range (Vaux) is +/- 10Vpk (20Vpk-pk).

Power source OUTPUT VOLTAGE = Vprogram + (Vaux x 25 x XFMRratio).

Input impedance is 600 ohms.

Full scale Gain Bandwidth from the auxiliary inputs to UPC outputs is > 100 kHz.

Three **AM Inputs** are provided on J5, one per phase. A varying DC voltage may be used to Amplitude Modulate the output.

AM Input voltage range (Vam) is +/- 10Vdc (20Vpk-pk).

Power source OUTPUT VOLTAGE rms =
Vprogram rms + (Vam/10 x (150 x XFMRratio))

limited by the output voltage range of the power source. **Caution:** Attempting to drive the OUTPUT VOLTAGE beyond the voltage range of the power source will result in a clipped (distorted) output waveform.

Input impedance is 600 ohms.

2.3.7 DIGITAL OUTPUTS

Digital outputs on J5 are 0 to 5 VDC, positive logic.

Logic outputs are:

SYNC OUT, Positive Zero Crossing (0°) of Phase A analog output.

Transient Pedestal, true when a transient is in progress.

Transient Trigger, pulse at the start of a transient event.

DRM, 1024 times output frequency.

F1,F2,F3,F4 are not to be connected to anything external to the UPC.

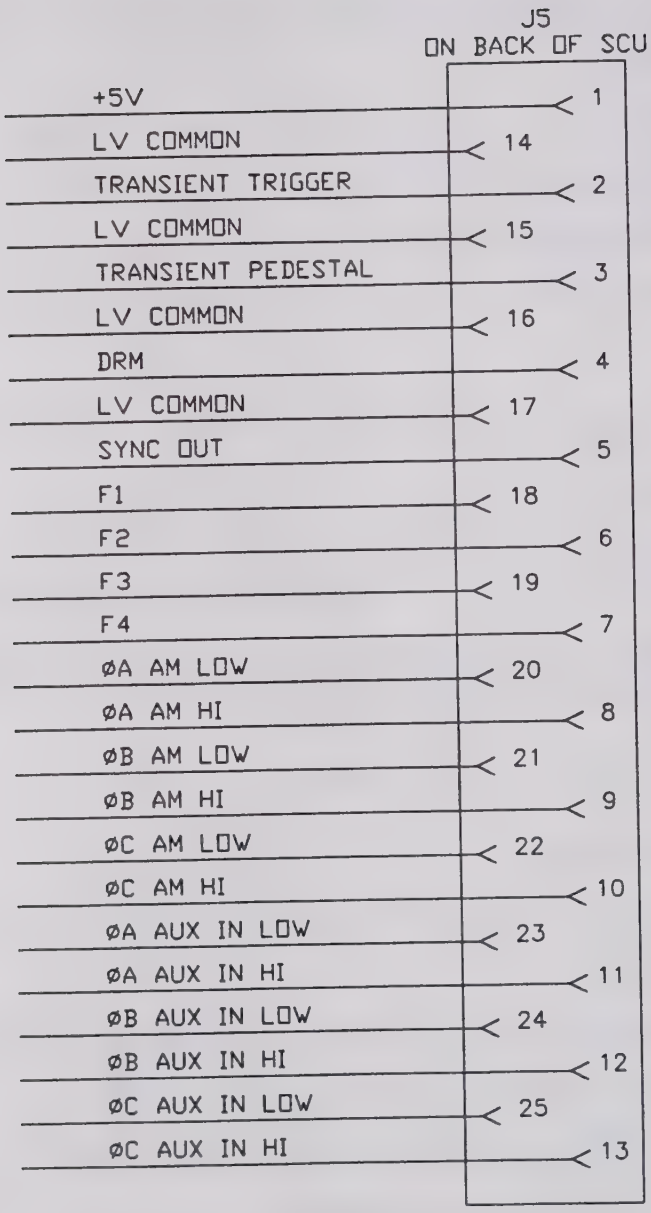

FIGURE 2.3.6 J5 AUXILIARY INPUTS AND OUTPUTS

2.3.8 METERING INPUTS

Metering inputs are on J2. Common mode must be within ± 10 V_{peak} with respect to power supply common.

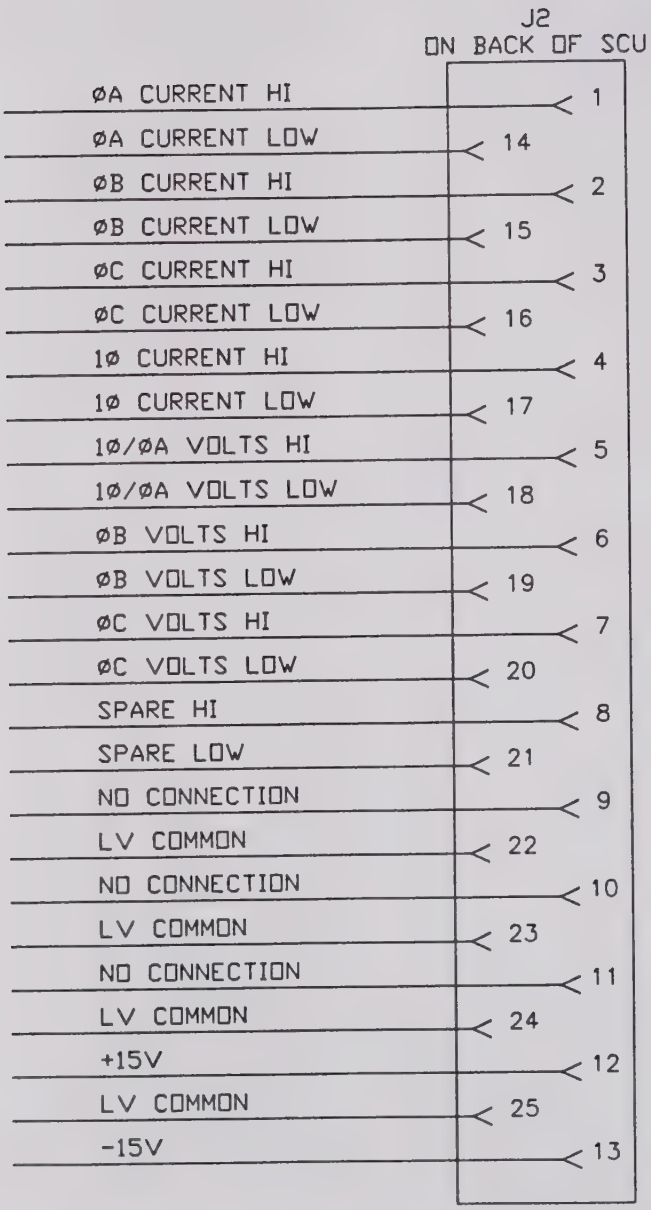

FIGURE 2.3.8 J2 METERING INPUTS

2.4 GPIB REMOTE INTERFACE

The GPIB Remote Interface is provided on J4. It has listener and talker capabilities.

The GPIB device address is set via the UPC STATUS display screen. Default address is 1. See section 4.5.3.3 for configuration and section 5 for programming information.

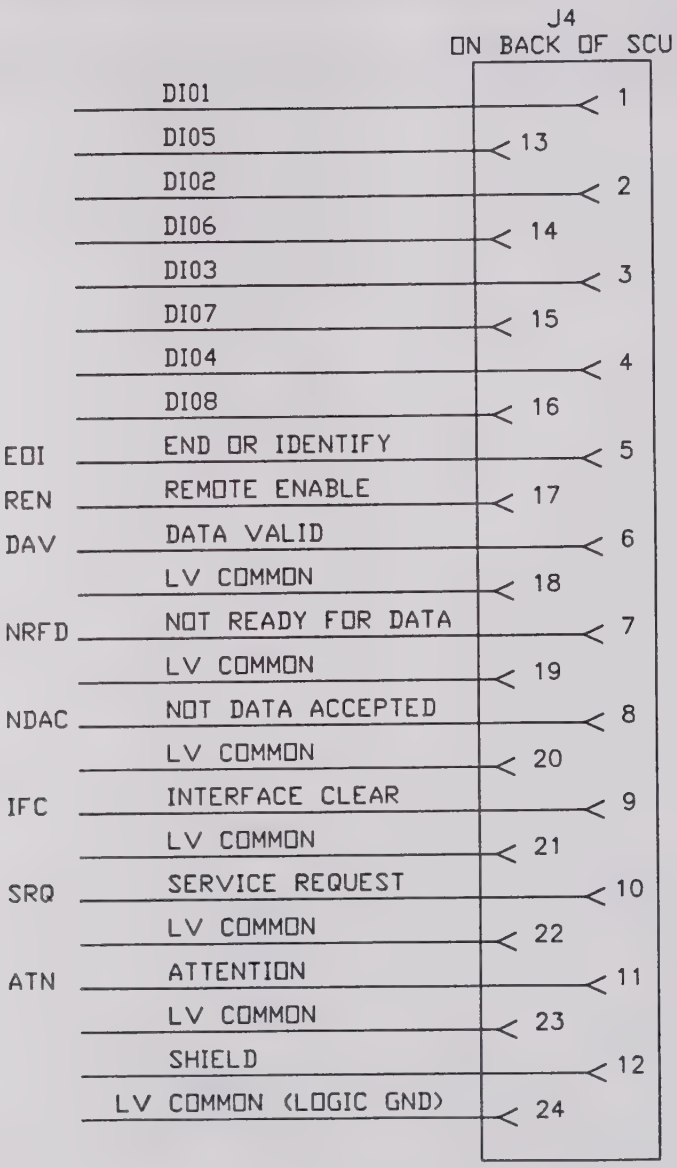

FIGURE 2.4 J4 GPIB INTERFACE

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SECTION 3

INSTALLATION

3 INSTALLATION

This section describes installation of an UPC into a SCU. **NOTE**: It is recommended that the user return the product to the factory should a controller or power source upgrade be desired, however, the following information is provided for reference. Refer to the AMX/ASX Series manual for installation into an AMX-Series Power Source. Should a question arise, call Pacific Power Source, toll free, at 1-800-854-2433 (1-800-472-8465 inside Ca.).

*** * * WARNING * * ***

LETHAL POTENTIALS ARE CONTAINED WITHIN THE SYSTEM.

DO NOT REMOVE ANY PANELS OR COVERS WITHOUT FIRST OPENING ALL CIRCUIT BREAKERS AND THEN REMOVING THE INPUT SERVICE.

*** * * WARNING * * ***

- - - CAUTION - - -

READ SECTION 3 OF THIS MANUAL
BEFORE INSTALLING A UPC INTO
AN SCU OR A POWER SOURCE.

- - - CAUTION - - -

3 INSTALLATION (cont)

The installation of a UPC into an SCU consists of the following steps:

1) Open all Circuit Breakers and remove Input Service.
(Refer to paragraph 3.1)

2) Remove cover and cabling.
(Refer to paragraph 3.2)

3) Remove existing controller.
(Refer to paragraph 3.3)

4) Configure UPC.
(Refer to paragraph 3.4)

5) Install UPC.
(Refer to paragraph 3.5)

6) Install cabling and cover.
(Refer to paragraph 3.6)

7) Connect Input Service and turn on.
(Refer to paragraph 3.7)

3.1 REMOVE INPUT SERVICE

Turn the Input Power Circuit Breaker on the front panel OFF. Then disconnect the Input Line Cord from the rear of the SCU chassis. See figure 3.5.

3.2 REMOVE COVER AND CABLING

Remove six screws from the top cover then remove the top cover.

Remove J2A from P2A.

Remove J3A of the existing controller from P3A the LED PCB.

Disconnect J4 from the rear panel of the SCU. Reattach mounting hardware to J4.

Disconnect J5 from the rear panel of the SCU. Reattach mounting hardware to J5.

Remove J6A of the SCU from P6A of the UPC INTERFACE PCB.

Remove J3B of the SCU from P3B of the LED PCB.

3.3 REMOVE EXISTING CONTROLLER

Remove the LED PCB by removing the four nuts holding the LED PCB to the SCU front panel.

Remove the existing controller by removing the four nuts holding the UPC front panel to the SCU front panel.

3.4 CONFIGURE UPC

The UPC TRANSFORMER RATIO and AMPS TO VOLTS RATIO must be configured to operate with the Power Source. Setting the GPIB device address or RS-232 SERIAL Interface parameters is optional depending on whether the user intends to use the REMOTE interface.

3.4.1 CONFIGURE TRANSFORMER RATIO

NOTE: Most users will not need to concern themselves with the following configuration issue as it is set at the factory if the UPC is packaged with a power source.

Set the TRANSFORMER RATIO of the UPC the same as the turns ratio of the Output XFMR in the Power Source. Refer to the Power Source Manual to determine the TRANSFORMER RATIO of the Power Source. The ratio is set by the TRANSFORMER RATIO SWITCH on the UPC METERING PCB. See figure 3.4.1. The Dip-switches S2-8 and S1-1 thru S1-8 are binary weighted. For example:

RATIO	DIP-SWITCH SETTING								
	S1-8	S1-7	S1-6	S1-5	S1-4	S1-3	S1-2	S1-1	S2-8
WEIGHTING VALUE	2.56	1.28	.64	.32	.16	.08	.04	.02	.01
*NO XFMR	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
0.50	OFF	OFF	OFF	ON	ON	OFF	OFF	ON	OFF
1.00	OFF	OFF	ON	ON	OFF	OFF	ON	OFF	OFF
1.50	OFF	ON	OFF	OFF	ON	OFF	ON	ON	OFF
2.00	OFF	ON	ON	OFF	OFF	ON	OFF	OFF	OFF
2.50	OFF	ON	ON	OFF	OFF	ON	ON	OFF	ON
5.11	ON	ON	ON	ON	ON	ON	ON	ON	ON

NOTE: TRANSFORMER RATIOs are implied as a ratio to one, eg; a ratio of 2.5 is implied as a ratio of 2.5:1 .

*NOTE: Set all bits to OFF to indicate NO TRANSFORMER installed.

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3.4.2 CONFIGURE AMPS TO VOLTS RATIO

NOTE: Most users will not need to concern themselves with the following configuration issue as it is set at the factory if the UPC is packaged with a power source.

The ammeter scale is selected by the AMPS TO VOLTS RATIO SWITCH multiplied by a factor of 10. The AMPS TO VOLTS RATIO interprets the voltage fed into the ammeter circuit input to represent a given amount of current. This switch may be set from 0 to 511. If 5 is selected then the amps to volts ratio is:

5 A (load current) = 1 V (input to ammeter circuit) = 5 A displayed.

In this case, the ammeter range is 50 A (5 x 10).

Set the AMPS TO VOLTS RATIO of the UPC the same as the Power Source. Refer to the Power Source Manual to determine the AMPS TO VOLTS RATIO of the Power Source. The ratio is set by the AMPS TO VOLTS RATIO SWITCH on the UPC METERING PCB. See figure 3.4.1. The 4 LSB's of the Dip-switch are binary weighted. For example:

	DIP-SWITCH SETTING					
	S2-6	S2-5	S2-4	S2-3	S2-2	S2-1
WEIGHT:	**X100**	**X10**	**8**	**4**	**2**	**1**
RATIO						
NA	OFF	OFF	OFF	OFF	OFF	OFF (DO NOT USE)
1	OFF	OFF	OFF	OFF	OFF	ON
2	OFF	OFF	OFF	OFF	ON	OFF
3	OFF	OFF	OFF	OFF	ON	ON
4	OFF	OFF	OFF	ON	OFF	OFF
5	OFF	OFF	OFF	ON	OFF	ON
6	**OFF**	**OFF**	**OFF**	**ON**	**ON**	**OFF**
7	OFF	OFF	OFF	ON	ON	ON
8	OFF	OFF	ON	OFF	OFF	OFF
9	OFF	OFF	ON	OFF	OFF	ON
10	OFF	OFF	ON	OFF	ON	OFF
11	OFF	OFF	ON	OFF	ON	ON
12	OFF	OFF	ON	ON	OFF	OFF
13	OFF	OFF	ON	ON	OFF	ON
14	OFF	OFF	ON	ON	ON	OFF
15	**OFF**	**OFF**	**ON**	**ON**	**ON**	**ON**
20	OFF	ON	OFF	OFF	ON	OFF
50	OFF	ON	OFF	ON	OFF	ON
100	ON	OFF	OFF	OFF	OFF	ON
200	ON	OFF	OFF	OFF	ON	OFF
400	ON	OFF	OFF	ON	OFF	OFF

NOTE: S2-7 Must be set "ON" if the attached power source has only 2 power amps.

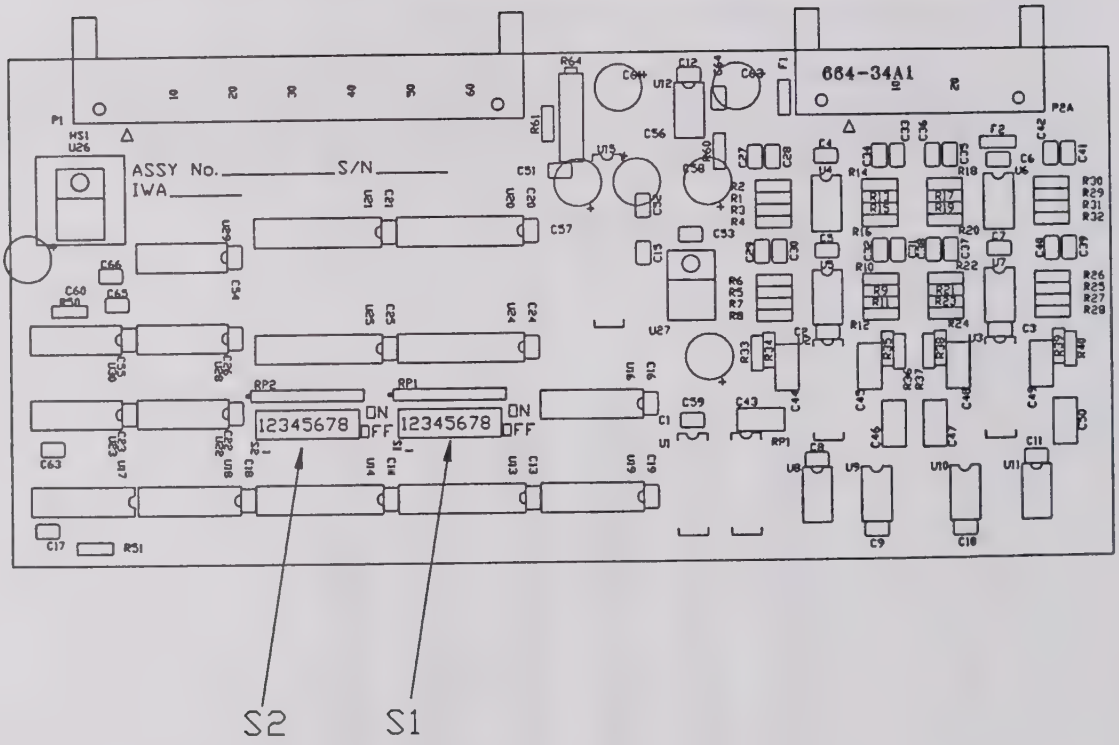


FIGURE 3.4.1 METERING PCB

3.4.3 CONFIGURE GPIB DEVICE ADDRESS

Set the GPIB DEVICE ADDRESS as desired. The GPIB device address is set via the UPC STATUS display screen. Default address is 1. See section 4.5.3.3 for configuration.

NOTE: IEEE-488 type cables with 90° "cable to connector" bends may interfere with other interface connectors on the SCU and some power source model's rear panels. It is recommended that a straight "cable to connector" IEEE-488 cable be used (NATIONAL INSTRUMENTS type X5) or a 90° adapter be used.

3.4.4 CONFIGURE INTERFACE

NOTE: Most users will not need to concern themselves with the following configuration issue as it is set at the factory if the UPC is packaged with a power source.

The configuration is set by the UPC CONFIGURATION SWITCH on the UPC INTERFACE PCB. See figure 3.4.4.

DIP-SWITCH SETTING

S1-5	ON	RS-232 INTERFACE INSTALLED
S1-5	OFF	IEEE-488 INTERFACE INSTALLED
S1-6	ON	FRONT PANEL INSTALLED
S1-6	OFF	FRONT PANEL NOT INSTALLED; Allows for maximum REMOTE INTERFACE performance.
S1-7	ON	METERING PCB INSTALLED
S1-7	OFF	METERING PCB NOT INSTALLED; Allows for enhanced Transient and REMOTE INTERFACE performance. OFF position ignored if CSC is enabled.
S1-8	ON	ϕB AND ϕC OSCILLATOR PCBS INSTALLED; Allows for 3ϕ operation.
S1-8	OFF	ϕB AND ϕC OSCILLATOR PCBS NOT INSTALLED

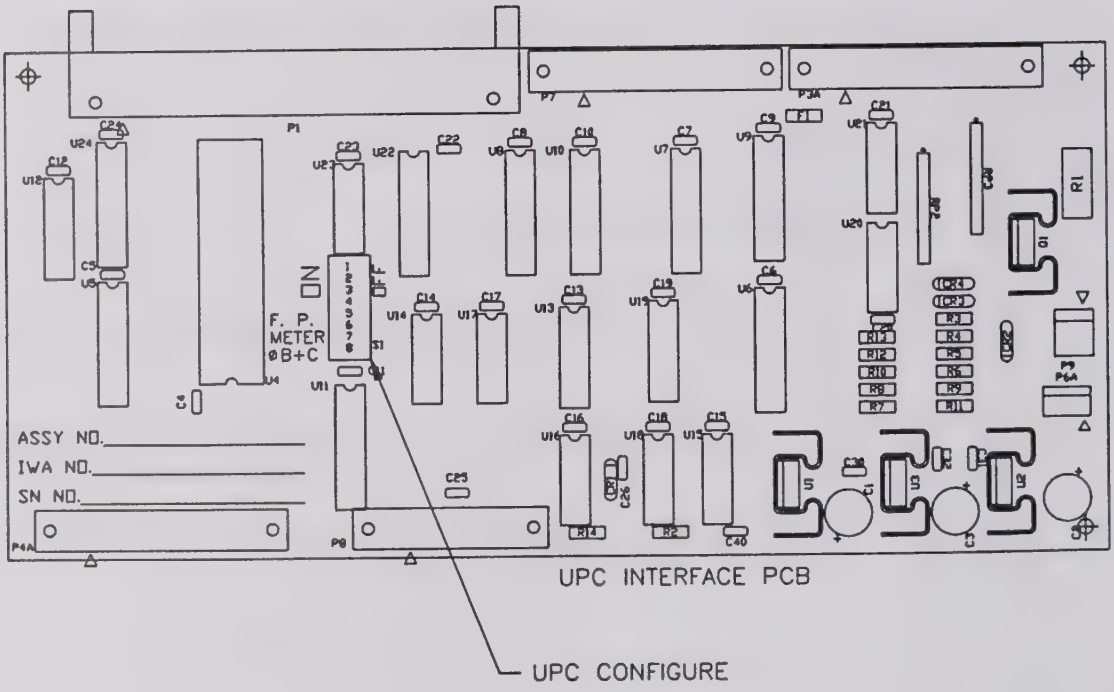


FIGURE 3.4.4 UPC CONFIGURATION DIP-SWITCH

3.5 INSTALL UPC

NOTE: Most users will not need to concern themselves with the following installation issue if the UPC is packaged with a power source.

Install the UPC with four nuts, attaching the UPC front panel to the SCU front panel. See figure 3.5.

Install LED PCB with four nuts, attaching the LED PCB to the SCU front panel.

3.6 INSTALL CABLING AND COVER

NOTE: Most users will not need to concern themselves with the following installation issue if the UPC is packaged with a power source.

Connect J2A of the UPC to P2A of the SCU.

Connect J3A of the UPC to P3A the LED PCB.

Connect J3B of the SCU to P3B of the LED PCB.

Attach J4 from the UPC to the rear panel of the SCU.

Attach J5 from the UPC to the rear panel of the SCU.

Connect J6A of the SCU to P6A of the UPC INTERFACE PCB.

Place the top cover on top and install six screws.

3.7 CONNECT INPUT SERVICE

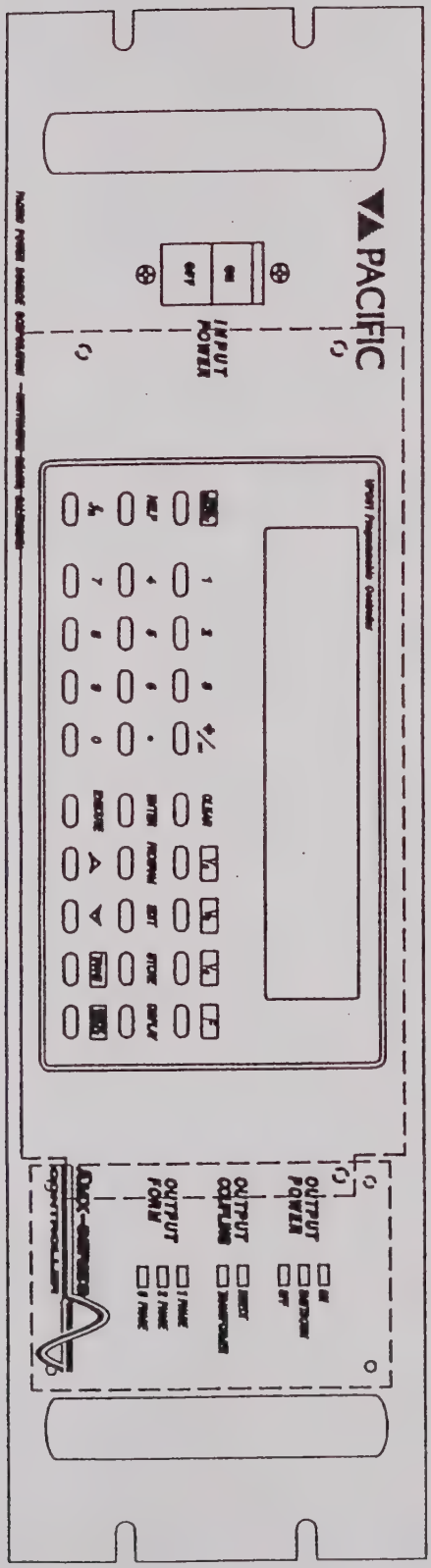
Verify the Input Power Circuit Breaker on the front panel is off. Connect the Input Line Cord to the back of the SCU chassis. Verify the 115/230 volt switch on the rear panel is set to the correct position. Input frequency may be 50 - 400 Hz.

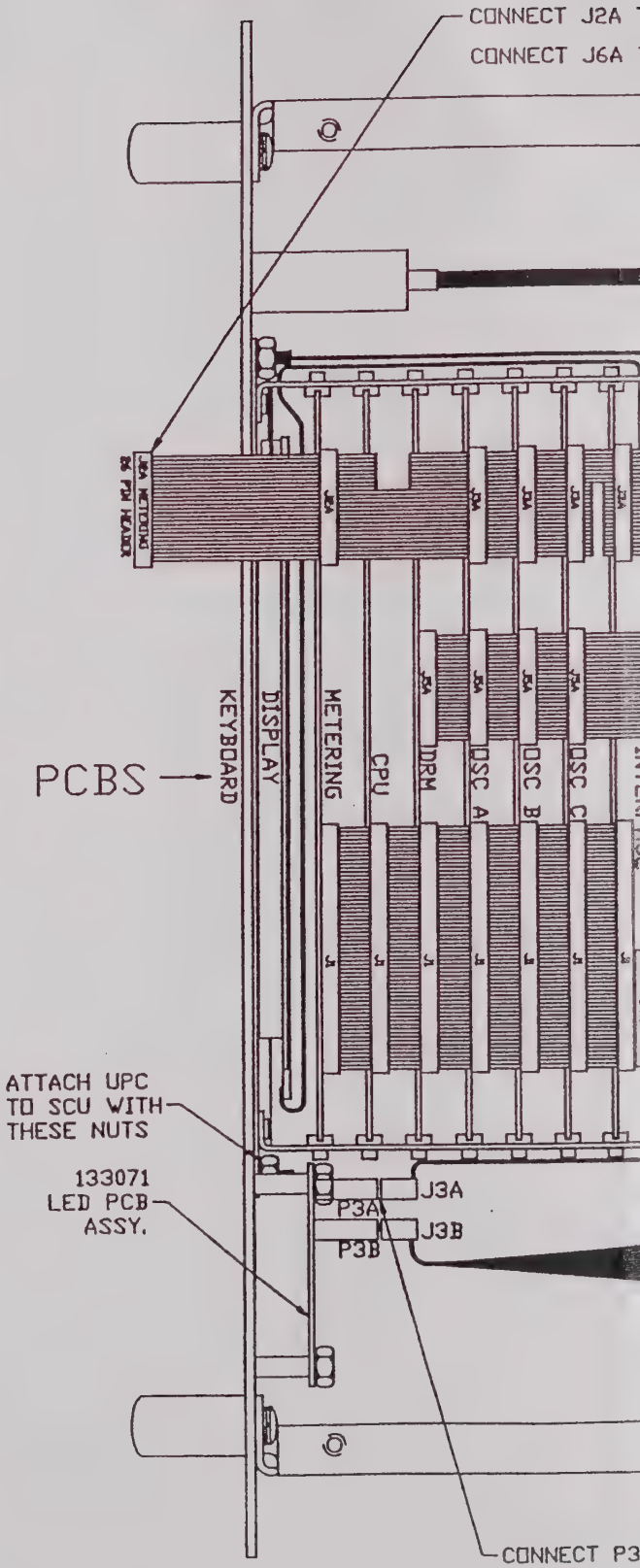
- - - C A U T I O N - - -

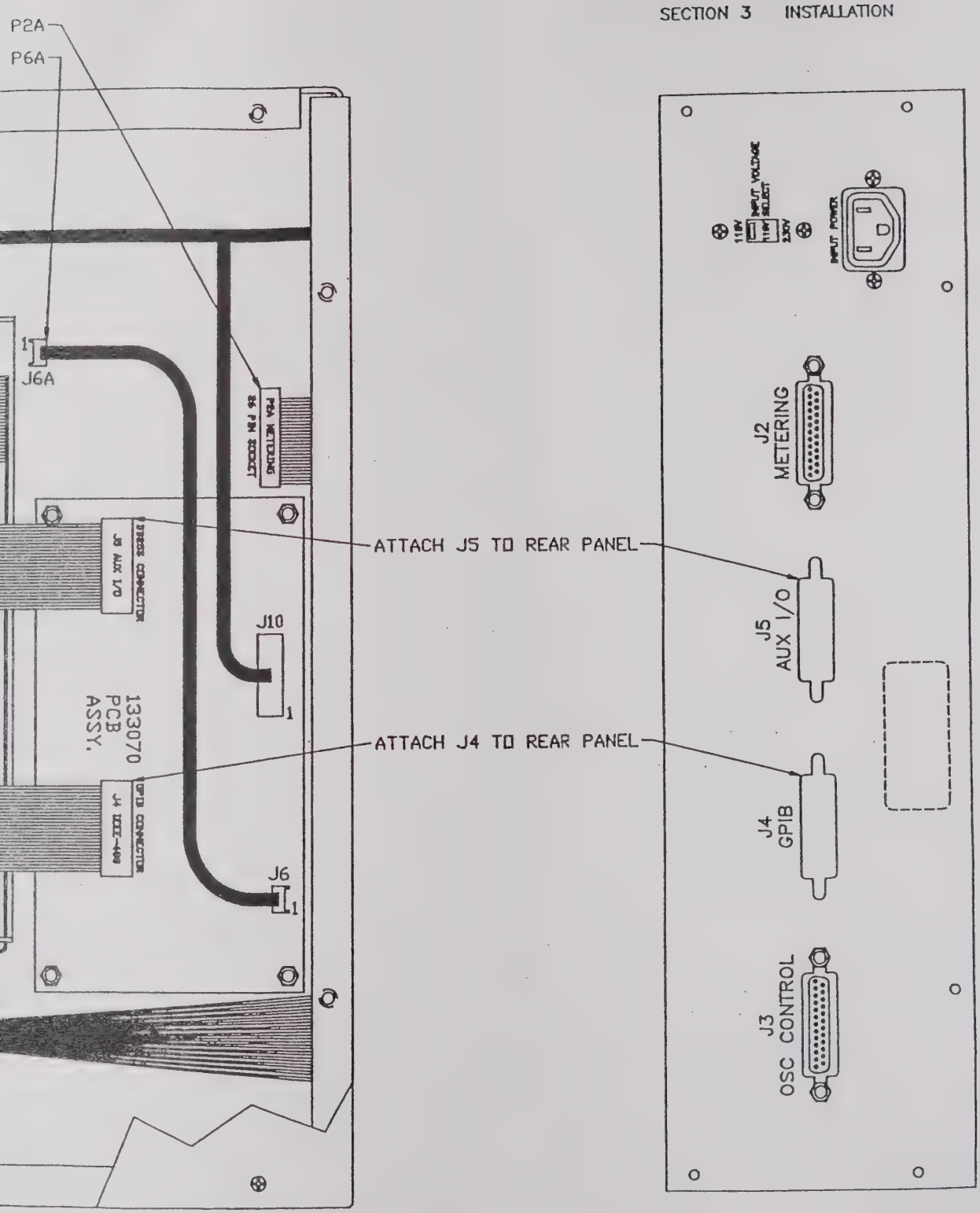
USE OF EQUIPMENT CONNECTED
TO IMPROPER VOLTAGE
MAY CAUSE PERMANENT DAMAGE
AND VOID WARRANTY.

- - - C A U T I O N - - -

Turn the Input Circuit Breaker ON. Refer to section 4 to verify proper operation.


PACIFIC
INPUT POWER


CONNECT J2A
CONNECT J6A
PCBS
KEYBOARD
DISPLAY
METERING
CPU
DRM
OSC A
OSC B
OSC C
ATTACH UPC TO SCU WITH THESE NUTS
133071 LED PCB ASSY.
J3A
J3B
P3A
P3B
CONNECT P3



TO J3A

FIGURE 3.5 INSTALLATION

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SECTION 4

FRONT PANEL OPERATION

4 FRONT PANEL OPERATION

This section describes the front panel operation of an UPC Controller installed an AMX/ASX Series Power Source.

The UPC Controller allows the user to control all output parameters of the AMX/ASX Series power source via the front panel keyboard as well as through the REMOTE interface (see Section 5 for REMOTE operation).

4.0 USERS GUIDE TO QUICK OPERATION

The purpose of this sub-section is two-fold:

1. to give the user a **QUICK OVERVIEW** of UPC operation (para. 4.0.1),

2. to help the user to **QUICKLY PUTTING THE UNIT TO USE** without having to master all of its complexities (para. 4.0.2).

4.0.1 QUICK OVERVIEW

The study of this section is a must. In addition to quick usage, this section gives the user a level of familiarity which is quite essential later when studying UPC operation in depth.

The UPC is operable either from its front panel (LOCAL CONTROL operation) or by it's IEEE-488 Bus (REMOTE CONTROL operation). A host computer can force REMOTE CONTROL when it is displaying a Metering display. LOCAL CONTROL can be resumed either by a bus command (GoTo Local) or by the operator pressing the **LOCAL** key. The host computer can force retention of REMOTE CONTROL by issuing a lockout command (Local LockOut (LLO) see section 5.6.1).

In order to gain quick familiarity and usage of the UPC, it is useful to think of its being in one of 4 operating "modes" when in LOCAL CONTROL.

1. MANUAL OPERATE
2. PROGRAM OPERATE
3. PROGRAM EDIT
4. SETUP

The MANUAL MODE is just what the word implies. Voltage and Frequency parameters are manually chosen from the front panel. Volts and frequency may be directly entered through the numeric keyboard. Alternatively they may be smoothly varied by use of the "slew" controls (up and down arrows). The V/I METER display (default display) tells the operator both command values and metered values. Stored transients may not be executed in the MANUAL MODE.

4.0.1 QUICK OVERVIEW (cont)

The PROGRAM OPERATE mode attempts to simplify certain test operations by allowing the operator to execute pre-stored programs (certain combinations of Volts, Frequency, Output Coupling, Transformer tap selection if any, Phase angle, Waveform, and Current limit. A stored program can be executed simply by pressing **PROGRAM**, entering a program number and **EXECUTE**. Up to 99 programs can be stored - with or without associated transients as desired. After a program is called up by number, **EXECUTE** causes the base - or static - portion of the program to be executed. These base parameters are commonly referred to as "Steady-state" parameters. Execution of the transient portion is separately controlled by the **TRANS** key.

The PROGRAM EDIT mode allows the operator to create new programs, or change existing programs. It is noteworthy that programs can be edited without disrupting power source output. That is, if the operator is executing program 15, program 23 can be edited without interrupting execution of program 15.

The SETUP MODE is one in which the operator can make certain semi-permanent changes in system configuration. Examples are:

Set Min and Max Voltage limits
Set Min and Max Frequency limits
Set Programmable output impedance
Set Transition time
Set Slew rates
Calibrate Meters
Calibrate Programmable output impedance
Set Range Control (if supported by Power source)
Create new waveforms
Copying waveforms
Modifying existing waveforms
Copy programs
Delete programs
Erase memory
Local/Remote meter source
Engage/disengage CSC
Program Output Impedance (optional)
Change view angle
Monitor UPC and Power Source status
Synthesize Waveforms from Harmonic values

CHANGING MODES

Changing from one mode to another is simple, and occurs as a result of invoking a specific function of a mode. All modes can be accessed from the V/I METER display. On first turn-on the system will operate at some set of default parameters set by the factory. The display will be the V/I METER display. This is the default - and most frequently used - display. It shows basic operating parameters, and in the lower left portion shows the operating mode.

4.0.1 QUICK OVERVIEW (cont)

For example, from the SETUP mode (**fn** key), pressing **CLEAR** a few times returns the V/I METER display. From the PROGRAM EDIT mode, either completion of EDIT or pressing **CLEAR** a number of times will return the V/I METER display.

Once the V/I METER display is on, the UPC will accept a mode selection entry.

fn for SETUP mode
PROGRAM EXECUTE for PROGRAM OPERATE mode
PROGRAM EDIT for PROGRAM EDIT mode
Va,Vb,Vc or **F** for MANUAL MODE

A further aid in manual operation are the panel LED lights. When Va,Vb,Vc or F lamps are on, that means that the unit is in MANUAL MODE and the illuminated parameters are accessed for new entry - either by numeric entry or slew control (UP and DOWN arrows). In PROGRAM OPERATE mode these lamps are extinguished.

The five keys in the lower right portion of the keyboard (highlighted with a different color) are executive keys. Every attempt has been made to ensure that:

- In order to change power applied to the load one of these keys must be pressed.
- Whenever one of these keys is pressed, power to the load may be changed.

This operational feature has been programmed in to help keep the user from accidentally pressing the wrong key and unintentionally changing power to the load.

> Remember! When you press a BLACK key something will probably happen to change output power.

4.0.1 QUICK OVERVIEW (cont)

QUICK OVERVIEW SUMMARY.

The system has four basic modes of controlling output parameters when it is in Local (non-REMOTE) control:

1) MANUAL MODE allows direct modification of output parameters. (Refer to paragraph 4.2)

2) PROGRAM OPERATE MODE allows pre-stored program execution including transients. (Refer to paragraph 4.3)

3) PROGRAM EDIT MODE allows editing of stored programs including transients. (Refer to paragraph 4.4)

4) SETUP MODE is used to copy and delete programs, erase memory, copy and edit waveforms. You may set meter sense point, CSC on or off, Output Impedance (optional), set Output range (for power sources that support it), transition time, min and max volts & frequency and LCD (view angle and backlight). Calibration for metering and Programmable output impedance may also be performed. Status is given for firmware version, GPIB device address or RS-232 SERIAL Interface parameters, Transformer ratio, amps to volts ratio and the Power Source. (Refer to paragraph 4.5)

4.0.2 QUICKLY PUTTING THE UNIT TO USE

The following steps provide a quick method (using MANUAL MODE) for setting Voltage and Frequency and applying power to a load. In addition to programming voltage and frequency, PROGRAM EDIT MODE allows you to setup phase angle, waveform, current limit, power form and coupling mode. It also allows you to setup transient events. Programming and executing a stored program is described in sections 4.4 and 4.3 respectively, or see the **HOW TO** reference for a list of individual functions.

QUICK MANUAL MODE OPERATION

1. **DO NOT CONNECT A LOAD** to the power source until you are satisfied that the power source output is appropriate for the load.

2. TURN the **OUTPUT POWER SWITCH OFF**. Then apply input power to the UPC or power source using it's INPUT POWER SWITCH. Allow a few seconds for the UPC to initialize itself. It will beep twice when it is ready.

3. The V/I METER will appear. This is the default display. It shows metered Volts and Amps (AC RMS). It also shows the Voltage and Frequency entries in the upper right corner of the display as the user is entering or changing them.

4. TO CHANGE VOLTAGE - Light the **Va**, **Vb** and/or **Vc** LEDs by pressing the keys below them. Now perform one of the following steps.
   A. Enter a numeric value on the keypad and press **EXECUTE**. - or -
   B. Press the UP or DOWN arrows to 'slew' the voltage.
   The phases that are indicated by the V LEDs will be changed to the voltage selected.

5. TO CHANGE FREQUENCY - Light the **F** LED by pressing the F key. Now perform one of the following steps.
   A. Enter a numeric value on the keypad and press **EXECUTE** - or-
   B. Press the UP or DOWN arrows to 'slew' the frequency.

   NOTE: You cannot change Voltage and Frequency at the same time using MANUAL MODE.

   NOTE: OBSERVE ALL SAFETY WARNINGS AND CAUTIONS LISTED AT THE START OF THIS MANUAL !!!

6. TO CLOSE THE OUTPUT CONTACTOR - First switch the **OUTPUT POWER** switch on the power source front panel to ON. Then press the **OUTPUT ENABLE** key on the UPC (controller). Verify the power source output (rear panel output terminals) is generating the desired voltage, frequency and phase angle using an oscilloscope.

7. TO APPLY POWER TO THE LOAD, first **TURN OFF the INPUT POWER** switch, **TURN OFF the OUTPUT POWER** switch. Connect the load to the rear panel output terminals. Switch ON the INPUT POWER switch, switch ON the OUTPUT POWER switch. Then press the **OUTPUT ENABLE** key on the UPC (controller). Power is now being applied to the load.

4.1 FRONT PANEL CONTROLS AND INDICATORS

This section shows the locations and defines the functions of the front panel controls and indicators of the UPC as installed in an AMX/ASX Series power source. Operation of an UPC installed in an SCU is identical except the SCU has no Output Power Switch. See figure 4.1.

4.1.1 POWER SOURCE FRONT PANEL

1) **INPUT POWER** (Circuit Breaker) - Used as the main input power ON/OFF control and protects the power source from drawing excessive input current from the input A.C. line.

2) **OUTPUT POWER** (Rocker Switch) - Controls the Output Contactor between the power source and the load.

This switch must be in ON/AUTO to allow the UPC to control the Output Contactor. In the OFF position the UPC cannot close the Output Contactor.

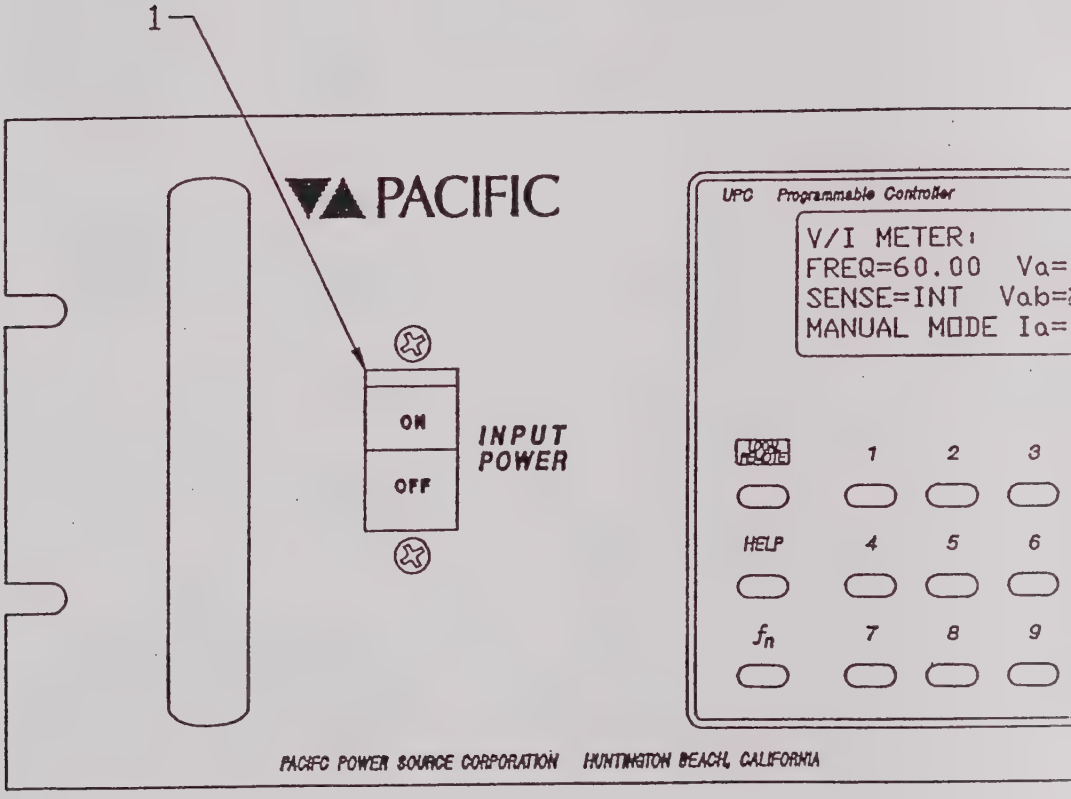
3) **OUTPUT POWER** (LEDs) - ON is illuminated when the Output Contactor is closed.

OFF is illuminated when the Output Contactor is open.

SHUTDOWN indicates the Power Source is in an error condition.

4) **OUTPUT COUPLING** (LEDs) - DIRECT is illuminated when the Power Amplifier is directly connected to the Output Contactor.

TRANSFORMER is illuminated when the Power Amplifier is connected to Transformers and the Transformers are connected to the Output Contactor.


1
PACIFIC
ON
OFF
INPUT
POWER
UPC Programmable Controller
V/I METER:
FREQ=60.00 Va=
SENSE=INT Vab=
MANUAL MODE Ia=
REMOTE
1
2
3
HELP
4
5
6
fn
7
8
9
PACIFC POWER SOURCE CORPORATION HUNTINGTON BEACH, CALIFORNIA

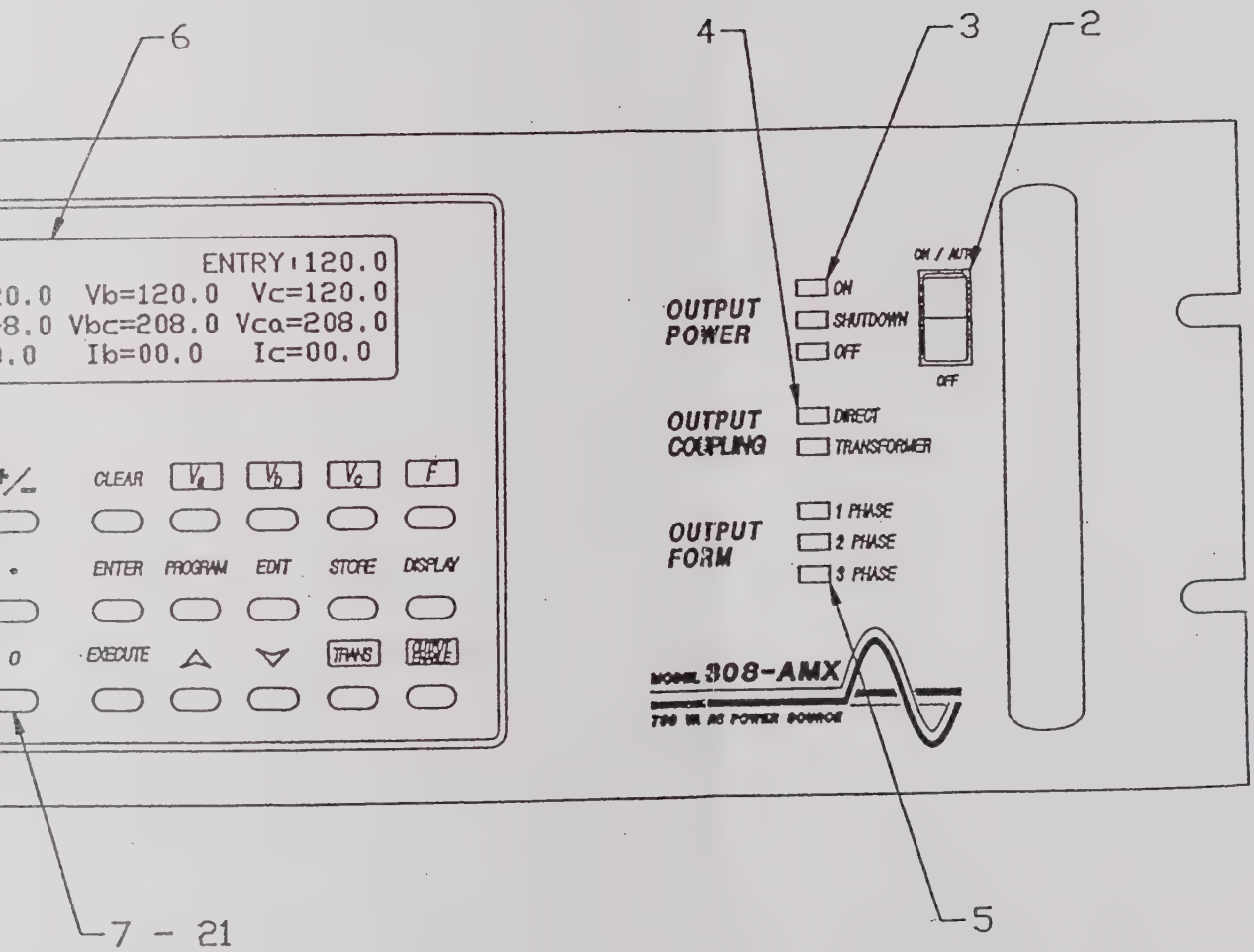


FIGURE 4.1 FRONT PANEL

4.1.1 POWER SOURCE FRONT PANEL (cont)

5) **OUTPUT FORM (LEDs) -**

1 PHASE is illuminated when the Power Source is connected to the 1 Phase Output Contactor. Only the 1ϕ Output Terminal will become active.

2 PHASE is illuminated when the Power Source is connected to the 3 Phase Output Contactor. Only ϕA and ϕB Output Terminals will become active.

3 PHASE is illuminated when the Power Source is connected to the 3 Phase Output Contactor. ϕA, ϕB and ϕC Output Terminals will become active.

4.1.2 UPC FRONT PANEL

6) **LIQUID CRYSTAL DISPLAY (LCD) -** Gives pertinent information to the user relating to front panel operation.

7) **LOCAL / REMOTE (KEY and LED) -** When the REMOTE INTERFACE is in control of the UPC and has not issued a local lockout command, this key will return control to the keyboard.

The LOCAL LED is lit when in LOCAL CONTROL.

The REMOTE LED is lit when in REMOTE CONTROL.

8) **HELP (KEY) -** From any METER display, this key provides help on how to operate the UPC.

9) **fn (KEY) -** When pressed from any meter display causes the UPC to enter SETUP MODE.

10) **NUMERIC KEYPAD -** Is used to enter numeric values. The +/- key toggles the sign of a numeric entry or toggles other two state parameters.

4.1.2 UPC FRONT PANEL (cont)

11) **CLEAR** (KEY) -

The first key press shall clear an entry and allow new values to be entered. The second key press shall backup the cursor one field. If several key presses backup to the first field in a display, the next key press shall abort edit functions and return to the V/I METER display.

12) **Va, Vb, Vc and F** (KEYs and LEDs) -

From the V/I METER display, pressing any of these keys causes MANUAL MODE to be active. When an LED is lit, this parameter is selected.

From the V/I METER display, if the Va, Vb or Vc key is pressed that LED toggles on or off and forces the F led off.

From the V/I METER display, if the F key is pressed that LED toggles on or off and forces Va, Vb and Vc LEDS off.

When in the V/I METER display and any of the Va, Vb, Vc or F LED(s) are lit, pressing an ARROW key causes selected parameters to slew.

When in the V/I METER display and any of the Va, Vb, Vc or F LED(s) are lit, entering a number then pressing EXECUTE causes selected parameters to change to new values.

13) **ENTER** (KEY) -

Is used to enter numeric values then go to the next field.

14) **PROGRAM** (KEY) -

When pressed from any meter display causes PROGRAM OPERATE MODE to be active.

15) **EDIT** (KEY) -

When pressed from the PROGRAM display causes PROGRAM EDIT MODE to be active. Pressing the EDIT key again causes the TRANSIENT display to be active.

4.1.2 UPC FRONT PANEL (cont)

16) **STORE** (KEY) - After editing, the STORE key is used to save new values.

17) **DISPLAY** (KEY) - Is used to cycle through the three meter displays. If a display other than a meter display is active it will abort edit functions and return to the V/I METER display.

18) **EXECUTE** (KEY) - In MANUAL MODE, causes the output to change to new values.

In PROGRAM OPERATE MODE, causes a new program to be executed.

In PROGRAM EDIT MODE and in the PROGRAM display, causes the program to be saved and executed.

In SETUP MODE is used to change the setup of the UPC.

19) **ARROW** (KEYS) When in MANUAL MODE, pressing an ARROW key causes the selected parameters to slew up or down. When in LIQUID CRYSTAL DISPLAY SETUP display, adjusts view angle or back light.

20) **TRANS** (KEY) When in PROGRAM OPERATE MODE and a transient is stored, pressing this key causes the transient to start or stop. When the LED is lit this indicates a transient is in progress.

21) **OUTPUT ENABLE** (KEY) Causes the output contactor enable to toggle on and off. When the LED is lit this indicates output enable is active.

4.2 MANUAL MODE

This section describes operation in Manual Mode.

In Manual Mode you may slew or directly enter (voltage or frequency). Parameters other than volts and frequency can only be changed by editing and executing a Steady-State program.

The V/I METER display will indicate MANUAL MODE in the lower left corner of the display.

4.2.1 METERING DISPLAYS

There are three primary metering displays plus a set of optional Harmonic Analysis displays. Pressing the DISPLAY key will cycle through the these metering displays. If a display other than a metering display is active, pressing the DISPLAY key will abort common edit functions and return to a metering display.

The V/I METER display indicates FREQuency, metering SENSE point (INTernal or EXTernal) and (MANUAL MODE or PROGRAM #) executing. This display meters true RMS Voltage (line to neutral and line to line) and true RMS current.

```
V/I METER:                        ENTRY: 120.0
FREQ=60.00   Va=120.0   Vb=120.0   Vc=120.0
SENSE=INT   Vab=208.0  Vbc=208.0  Vca=208.0
MANUAL MODE Ia=00.00    Ib=00.00    Ic=00.00
```

The POWER METER display meters kVA, true kW and PF.

```
POWER METER: PHASE A   PHASE B   PHASE C
KVA              0.000     0.000     0.000
KW               0.000     0.000     0.000
PF               1.000     1.000     1.000
```

The AMPS METER display meters RMS amps, PEAK amps and CREST FACTOR.

```
AMPS METER: PHASE A   PHASE B   PHASE C
RMS            0.00      0.00      0.00
PEAK           0.00      0.00      0.00
CREST FACTOR   1.00      1.00      1.00
```

4.2.1 METERING DISPLAYS (cont)

4.2.1.1 WAVEFORM ANALYSIS

Waveform analysis functions are optionally provided to report both magnitude and phase angle (relative to 0° of voltage) of each harmonic for metered voltage and current waveforms below 500 Hz.

THD, ODD and EVEN harmonic distortion measurement data are also available. They are calculated from the 2nd to the 51st harmonic magnitude (content) data.

Pressing the **DISPLAY** key repeatedly will display the following screen.

```
Press DISPLAY to view Harmonic Data.
Then use ENTER to UPDATE, CLEAR to EXIT.
      +/- selects VOLTS or CURRENT,
  The Va, Vb, Vc keys select the PHASE.
```

Pressing the **DISPLAY** key repeatedly at this point will display the HARMONIC DATA in memory with screens similar to the following.

```
φA CURRENT   THD=0.1 % OHD=0% EHD=0.1%
HARMONIC: 2nd  3rd  4th  5th  6th
CONTENT:  .1%  0%   0%   0%   0%
φANGLE:   0°   0°   0°   0°   0°
```

Use the **Va**, **Vb** and **Vc** keys to light the Phase LEDs to select which phase is to be updated or displayed.
Pressing the +/- key will toggle between current and voltage parameters.
The **CLEAR** key will return the display back to the V/I meter.

The **ENTER** key causes the UPC to measure a signal, and calculate and update the harmonic data in memory. This may take some number of seconds. A beep is heard when the update is complete. Only the parameter and phase selected as above is updated. Other parameters are retained. All parameters are then retained until power-off or the memory is cleared.

Pressing **EDIT** will allow the user to select the number of samples used during the analysis process. The default is 128, but 256 or 512 may be used with an increase in accuracy at a linear cost of processing time. Press **ENTER** after typing this number. Press **ENTER** again to process new data. Phase angles are displayed in the range of -180° to +180°.

THD is TOTAL HARMONIC DISTORTION for all harmonics of the selected parameter and phase.
OHD is ODD HARMONIC DISTORTION for all harmonics of the selected parameter and phase.
EHD is EVEN HARMONIC DISTORTION for all harmonics of the selected parameter and phase.

4.2.2 VOLTAGE ENTRY

To achieve Manual Mode and change voltage, from any meter display light the Va, Vb, Vc leds by pressing those keys.

Pressing an ARROW key causes selected voltages to slew up or down. Entering a number then pressing **EXECUTE** causes selected voltages to change to new values. The upper right corner of the display shows the last entered voltage.

For example to change to 125 volts, light Va, Vb and Vc leds as desired by pressing their keys. Enter **125** and press **EXECUTE**. The Power Source should now be generating 125 volts.

```
V/I METER:                        ENTRY: 125.0
FREQ=60.00   Va=125.0   Vb=125.0   Vc=125.0
SENSE=INT   Vab=216.5  Vbc=216.5  Vca=216.5
MANUAL MODE Ia=00.0     Ib=00.0     Ic=00.0
```

4.2.3 FREQUENCY ENTRY

To achieve Manual Mode and change frequency, from any meter display light the F led by pressing that key.

Pressing an ARROW key causes the frequency to slew up or down. Entering a number then pressing **EXECUTE** causes the frequency to change to the new value. The upper right corner of the display shows the last entered frequency.

For example to change to 60.50 hertz light the F led. Enter **60.50** and press **EXECUTE**. The Power Source should now be generating 60.50 hertz.

```
V/I METER:                        ENTRY: 60.50
FREQ=60.50   Va=120.0   Vb=120.0   Vc=120.0
SENSE=INT   Vab=208.0  Vbc=208.0  Vca=208.0
MANUAL MODE Ia=00.0     Ib=00.0     Ic=00.0
```

4.3 PROGRAM OPERATE MODE

This section describes Program Operate Mode.

Program Operate Mode allows pre-stored program execution including transients.

When the V/I METER display to is active the lower left corner will indicate PROGRAM #1 currently being executed.

4.3.1 PROGRAM EXECUTION

To achieve Program Operate Mode, from any meter display press the **PROGRAM** key. This will cause the PROGRAM display to become active. The last or currently executing program will be displayed. You may enter a new program number then press **ENTER** to view it.

```
PROGRAM: #1  FORM=3 COUPLING=DIRECT
FREQ=60      Va=120     Vb=120     Vc=120
            WFa=1      WFb=1      WFc=1
#SEGS=0    Ilim=50     PHb=120°   PHc=240°
```

Pressing **EXECUTE** now will cause that program to be executed and the V/I METER display to be active.

```
V/I METER:
FREQ=60.00  Va=120.0  Vb=120.0  Vc=120.0
SENSE=INT  Vab=208.0 Vbc=208.0 Vca=208.0
PROGRAM #1  Ia=00.0    Ib=00.0    Ic=00.0
```

4.3.2 TRANSIENT EXECUTION

The UPC must be in Program Operate Mode to execute a transient and the executing program must have a transient stored, this is indicated by #SEGS = 1 or more, in the lower left hand corner of PROGRAM display. From any metering display, pressing the **TRANS** key will start a transient at positive zero crossing of phase A. Pressing the **TRANS** key again will stop the transient if still active.

General steps to create a new transient program are as follows.

1. **Create or edit a program** using the method described in section 4.4.1. Executing the program at this point is optional.

2. **Create or edit the transient** portion of the program using the method described in section 4.4.2.

3. **Execute the program** using the method described in section 4.3.1.

4. **Execute the transient** by pressing the TRANS key. Pressing the **TRANS** key again will stop the transient if still active.

The minimum number of keystrokes to create a transient program is as follows.

1. From the V/I meter, press **PROGRAM**, enter the program number, press **ENTER**.

2. Press **EDIT**. Change steady-state values if desired, pressing **ENTER** after each entry.

3. Press **EDIT**. Change segment values if desired, pressing **ENTER** after each entry. Setting T to 0 in the first segment makes the transient a cycle based transient. Continue pressing **ENTER** to create new segments.

4. Press **STORE**. Enter the number of desired events then **STORE** again.

5. Execute the programs steady-state values by pressing **PROGRAM EXECUTE**.

6. Execute the programs steady-state values by pressing **TRANS**. Pressing the **TRANS** key again will stop the transient if still active.

4.3.2.1 MIL-STD-704D TRANSIENT PROGRAMS

The UPC is capable of producing the Voltage and Frequency excursions required by MIL-STD-704D.

Programs 100-103 are permanent, pre-stored, non-executable transient programs. These permanent programs may be copied to any of programs 1 - 99 for execution. To copy programs see section 4.5.1.1.

Program 100 is a MIL-STD-704D overvoltage transient.

Program 101 is a MIL-STD-704D undervoltage transient.

Program 102 is a MIL-STD-704D over-frequency transient.

Program 103 is a MIL-STD-704D under-frequency transient.

The four voltage and frequency programs are for equipment which is nominally powered by 115/200 volts and a nominal Frequency of 400 Hz. Transient program data is stated for over/under voltage and over/ under frequency tests as specified by paragraph 5.2.3 of MIL-STD-704D is provided in the following paragraphs.

The data presented in this section is based on MIL-STD-704D dated 30 SEP 1980.

NOTE: All four transients described are single event, 3 phase transients.

4.3.2.1 MIL-STD-704D TRANSIENT PROGRAMS (cont)

OVER-VOLTAGE TRANSIENT (Program #100)

The power source will produce the over-voltage transient excursion as defined by MIL-STD-704D (Paragraph 5.2.3.2.1). The power source must be configured for a voltage range of at least 180Vrms to perform this test.

INITIAL CONDITIONS:

f_o 400 Hz.
V_a, V_b, V_c 124 $VAC_{l\text{-}n}$ (Max High-Line Steady-State Limit)
WFa = 1, WFb = 1, WFc = 1, XFMR COUPLED, XFMR RATIO = 1.5

TRANSIENT COMMAND SEQUENCE:

Segment 1:
F = 400 Hz. Va = 180, Vb = 180, Vc = 180, T = 0

Segment 2:
F = 400, Va = 180, Vb = 180, Vc = 180, T = 0.01

Segment 3:
F = 400, Va = 124, Vb = 124, Vc = 124, T = 0.07

The above transient commands are stated for the transient voltage excursion to occur on all phases, simultaneously. MIL-STD-704D allows for the transient to occur on a single phase or on any combination of phases. To exclude a phase from the transient excursion simply change the appropriate Va, Vb or Vc field in Segment 1 to 124 volts.

4.3.2.1 MIL-STD-704D TRANSIENT PROGRAMS (cont)

UNDER-VOLTAGE TRANSIENT (Program #101)

The power source will produce the under-voltage transient excursion as defined by MIL-STD-704D (Paragraph 5.2.3.2.1). The power source must be configured for a voltage range of at least 108Vrms to perform this test.

INITIAL CONDITIONS:

f_o	400 Hz.
V_a, V_b, V_c	108 VAC_{l-n} (Min High-Line Steady-State Limit)

WFa = 1, WFb = 1, WFc = 1

TRANSIENT COMMAND SEQUENCE:

Segment 1:
F = 400 Hz. Va = 80, Vb = 80, Vc = 80, T = 0

Segment 2:
F = 400, Va = 80, Vb = 80, Vc = 80, T = 0.01

Segment 3:
F = 400, Va = 108, Vb = 108, Vc = 108, T = 0.07

The above transient commands are stated for the transient voltage excursion to occur on all phases, simultaneously. MIL-STD-704D allows for the transient to occur on a single phase or on any combination of phases. To exclude a phase from the transient excursion simply change the appropriate Va, Vb or Vc field in Segment 1 to 108 volts.

4.3.2.1 MIL-STD-704D TRANSIENT PROGRAMS (cont)

OVER-FREQUENCY TRANSIENT (Program #102)

The power source will produce the over-frequency transient excursion as defined by MIL-STD-704D (Paragraph 5.2.3.2.1). The power source must be configured for a voltage range of at least 115Vrms to perform this test.

INITIAL CONDITIONS:

f_o	407 Hz. (Max Steady-State Limit)
V_a, V_b, V_c	115 VAC_{l-n}
WFa = 1, WFb = 1, WFc = 1	

TRANSIENT COMMAND SEQUENCE:

Segment 1:
F = 425 Hz. Va = 115, Vb = 115, Vc = 115, T = 0

Segment 2:
F = 425, Va = 115, Vb = 115, Vc = 115, T = 1

Segment 3:
F = 420, Va = 115, Vb = 115, Vc = 115, T = 0

Segment 4:
F = 420, Va = 115, Vb = 115, Vc = 115, T = 4

Segment 5:
F = 410, Va = 115, Vb = 115, Vc = 115, T = 0

Segment 6:
F = 410, Va = 115, Vb = 115, Vc = 115, T = 5

4.3.2.1 MIL-STD-704D TRANSIENT PROGRAMS (cont)

UNDER-FREQUENCY TRANSIENT (Program #103)

The power source will produce the under-frequency transient excursion as defined by MIL-STD-704D (Paragraph 5.2.3.2.1). The power source must be configured for a voltage range of at least 115Vrms to perform this test.

INITIAL CONDITIONS:

f_o	393 Hz. (Min Steady-State Limit)
V_a, V_b, V_c	115 VAC_{l-n}
WFa = 1, WFb = 1, WFc = 1	

TRANSIENT COMMAND SEQUENCE:

Segment 1:
F = 375 Hz. Va = 115, Vb = 115, Vc = 115, T = 0-

Segment 2:
F = 375, Va = 115, Vb = 115, Vc = 115, T = 1

Segment 3:
F = 380, Va = 115, Vb = 115, Vc = 115, T = 0

Segment 4:
F = 380, Va = 115, Vb = 115, Vc = 115, T = 4

Segment 5:
F = 390, Va = 115, Vb = 115, Vc = 115, T = 0

Segment 6:
F = 390, Va = 115, Vb = 115, Vc = 115, T = 5

4.4 PROGRAM EDIT MODE

This section describes Program Edit Mode.

Program Edit Mode allows program and transient editing.

4.4.1 PROGRAM EDITING

To achieve Program Edit Mode, from any meter display press the **PROGRAM** key, program number, **ENTER** key then **EDIT** key. The cursor will move to FORM.

```
PROGRAM: #1  FORM=3 COUPLING=DIRECT
FREQ=60      Va=120     Vb=120     Vc=120
             WFa=1      WFb=1      WFc=1
#SEGS=0    Ilim=50     PHb=120°   PHc=240°
```

The following may be programmed:

FORM

Enter 1, 2, or 3 Phase output FORM.

1 PHASE is when the Power Source is connected to the 1 Phase Output Contactor. Only the 1ϕ Output Terminal will become active.

2 PHASE is when the Power Source is connected to the 3 Phase Output Contactor. Only ϕA and ϕB Output Terminals will become active and are 180° out of phase. Voltages are programmed phase to phase. This may be called split phase.

3 PHASE is when the Power Source is connected to the 3 Phase Output Contactor. ϕA, ϕB and ϕC Output Terminals will become active.

4.4.1 PROGRAM EDITING (cont)

COUPLING

Select DIRECT or XFMR (transformer) coupled output by pressing the +/- key.

DIRECT is when the Power Amplifier is directly connected to the Output Contactor.

XFMR is when the Power Amplifier is connected to Transformers and the Transformers are connected to the Output Contactor.

XFMR(N.N)

When XFMR coupled you may enter the transformer ratio. The transformer ratio for the system must be the same as this value before the program may be executed. Ratios from 1.1 to 2.5 are step up and ratios from 0.1 to 0.9 are step down.

FREQ

Any desired output frequency from 20.00 to 5000 hertz may be entered.

RANGE	RESOLUTION
20.00 - 99.99 Hz	0.01 Hz
100.0 - 999.9 Hz	0.1 Hz
1000 - 5000 Hz	1 Hz

Va, Vb, Vc

Line to neutral voltages are entered for 1ϕ and 3ϕ Forms. Line to Line voltages are entered for 2ϕ operation.

This drives Power Source direct coupled output from 0 to 150 volts rms (Line-Neutral) in steps of 0.1 volts or -
transformer coupled output, with a TRANSFORMER RATIO of .1-2.5, from 0 to 375 volts rms in steps of 0.1 volts for ratios of 1.0 or less, or - steps of 0.5 volts for ratios more than 1.0.

4.4.1 PROGRAM EDITING (cont)

WFa, WFb, WFc — Select the desired output waveform. Waveform 1 is always a sinewave. Waveform 2-16 may be copied and/or edited as desired using the SETUP (fn) functions.

The UPC will attempt to generate the selected waveform at the rms voltage programmed. Because of the difference in the rms voltage content of various waveforms the UPC may not be able to reproduce the waveform at the voltage desired. Selecting transformer coupled output with a higher ratio may solve this problem.

Ilim — Programmable current limit can be set as desired. The range will change depending upon which Power Source the UPC is controlling. One value is used for all three phases. This function is average responding, RMS programmed.

PHb, PHc — Phase angle can be set from 0-359° for Phase B and Phase C with reference to Phase A.

Pressing **STORE** at any time during editing will cause the program to be stored. The V/I METER display will become active.

Pressing **EXECUTE** at any time during editing will cause the program to be stored and executed. The V/I METER display will become active.

Pressing **EDIT** at any time allows transients to be created and edited. The TRANSIENT edit display will become active.

4.4.1.1 PROGRAM EXAMPLE

The following is an example of how to create and execute a 3 phase, 108/187 volt, 400 Hz program. From any metering display press the **PROGRAM** key.

```
PROGRAM: #1  FORM=3 COUPLING=DIRECT
FREQ=60      Va=120     Vb=120     Vc=120
             WFa=1      WFb=1      WFc=1
#SEGS=0    Ilim=50     PHb=120°   PHc=240°
```

Press **4 ENTER EDIT** to edit program #4.

```
PROGRAM: #4  FORM=3 COUPLING=DIRECT
FREQ=60      Va=120     Vb=120     Vc=120
             WFa=1      WFb=1      WFc=1
#SEGS=0    Ilim=50     PHb=120°   PHc=240°
```

Press **3 ENTER** to select 3 phase form.

```
PROGRAM: #4  FORM=3 COUPLING=DIRECT
FREQ=60      Va=120     Vb=120     Vc=120
             WFa=1      WFb=1      WFc=1
#SEGS=0    Ilim=50     PHb=120°   PHc=240°
```

Press **ENTER** to select DIRECT coupling. If XFMR is shown press +/- then **ENTER**.

```
PROGRAM: #4  FORM=3 COUPLING=DIRECT
FREQ=60      Va=120     Vb=120     Vc=120
             WFa=1      WFb=1      WFc=1
#SEGS=0    Ilim=50     PHb=120°   PHc=240°
```

Press **400 ENTER** to select 400 hertz.

```
PROGRAM: #4  FORM=3 COUPLING=DIRECT
FREQ=400     Va=120     Vb=120     Vc=120
             WFa=1      WFb=1      WFc=1
#SEGS=0    Ilim=50     PHb=120°   PHc=240°
```

4.4.1.1 PROGRAM EXAMPLE (cont)

Press **108 ENTER 108 ENTER 108 ENTER** to select 108 volts line to neutral on all three phases.

```
PROGRAM: #4  FORM=3 COUPLING=DIRECT
FREQ=400     Va=108     Vb=108     Vc=108
            WFa=1      WFb=1      WFc=1
#SEGS=0    Ilim=50     PHb=120°   PHc=240°
```

Press **1 ENTER 1 ENTER 1 ENTER** to select WaveForm 1 on all three phases.

```
PROGRAM: #4  FORM=3 COUPLING=DIRECT
FREQ=400     Va=108     Vb=108     Vc=108
            WFa=1      WFb=1      WFc=1
#SEGS=0    Ilim=50     PHb=120°   PHc=240°
```

Press **ENTER** to select default maximum Ilim for this Power Source.

```
PROGRAM: #4  FORM=3 COUPLING=DIRECT
FREQ=400     Va=108     Vb=108     Vc=108
            WFa=1      WFb=1      WFc=1
#SEGS=0    Ilim=50     PHb=120°   PHc=240°
```

Press **120 ENTER 240 ENTER** to select 120° phase shift for phase B and 240° phase shift for phase C referenced to phase A.

```
PROGRAM: #4  FORM=3 COUPLING=DIRECT
FREQ=400     Va=108     Vb=108     Vc=108
            WFa=1      WFb=1      WFc=1
#SEGS=0    Ilim=50     PHb=120°   PHc=240
```

Press **EXECUTE** to execute this new program. The V/I METER display will become active.

```
V/I METER:
FREQ=400.0  Va=108.0  Vb=108.0  Vc=108.0
SENSE=INT  Vab=187.1 Vbc=187.1 Vca=187.1
PROGRAM #4  Ia=00.0   Ib=00.0   Ic=00.0
```

4.4.2 TRANSIENT EDITING

To edit transients, Mode, from any meter display press the **PROGRAM** key, program number, **ENTER** key then **EDIT** key. The cursor will move to FORM. This example presumes the user has loaded the program #4 information as described in the previous example.

```
PROGRAM: #4  FORM=3 COUPLING=DIRECT
FREQ=400     Va=108     Vb=108     Vc=108
             WFa=1      WFb=1      WFc=1
#SEGS=0    Ilim=50     PHb=120°   PHc=240°
```

From the PROGRAM edit display pressing **EDIT** again allows transients to be created and edited. The TRANSIENT edit display will become active.

```
TRANSIENT: PRGM #4    SEGMENT #1    OF 1
T=0.0002     Va=108     Vb=108     Vc=108
F=400        WFa=1      WFb=1      WFc=1
```

The following may be programmed:

SEGMENT # — Segments are small portions of a transient. Each segment provides a linear transition in volts and/or frequency in the time indicated. Different waveforms may be switch in during each segment.

Normally don't enter a number here. It will automatically increment as required. Up to 100 segments may be used to generate a transient. If you want to go to a previously edited segment you may enter that segment number.

In the upper right hand corner the total number of segments are displayed. If you wish to reduce the number of segments in this transient you may enter the last segment here and then you must press STORE to save the transient.

4.4.2 TRANSIENT EDITING (cont)

T (Transition time)

Enter a time from 0.0002 to 300 seconds for a time based transient.

If cycle based transients are desired enter 0 in the first segment to make the transient a cycle based transient. The display will then show "1 CYCLE". The time for each segment will be 1 period of the output waveform. This is useful for switching in different waveforms on a cycle by cycle basis for sub-cycle transients.

Va, Vb, Vc

Line to neutral voltages are entered for 1ϕ and 3ϕ Forms. Line to Line voltages are entered for 2ϕ operation. This drives Power Source direct coupled output from 0 to 150 volts rms in steps of 0.1 volts or transformer coupled output, with a ratio of 2.5, from 0 to 375 volts rms in steps of 0.5 volts.

FREQ

Any desired output frequency from 20.00 to 5000 hertz may be entered.

RANGE	RESOLUTION
20.00 - 99.99 Hz	0.01 Hz
100.0 - 999.9 Hz	0.1 Hz
1000 - 5000 Hz	1 Hz

WFa, WFb, WFc

Select the desired output waveform. Waveform 1 is always a sinewave. Waveform 2-16 may be copied and/or edited as desired using the SETUP (fn) functions.

The UPC will attempt to generate the selected waveform at the rms voltage programmed at the beginning of each segment. Because of the difference in the rms voltage content of various waveforms, the UPC may not be able to reproduce the waveform at the voltage desired. Selecting transformer coupled output with a high ratio may solve this problem.

TRANSIENT EVENTS

Enter the number of times you wish the transient to repeat. 0 causes the transient to repeat until the **TRANS** key is pressed.

4.4.2.1 TIME BASED TRANSIENT EXAMPLE

The following is an example of how to create a MIL-STD-704D time based transient. (See section the beginning of section 4.3.2 regarding pre-stored transients).

Start with the previous program #4 example as shown in section 4.4.1. From any metering display press **PROGRAM 4 ENTER EDIT EDIT** and you should see the following display:

```
TRANSIENT: PRGM #4   SEGMENT #1   OF 1
T=0.0002    Va=108    Vb=108    Vc=108
F=400      WFa=1     WFb=1     WFc=1
```

Press **1 ENTER ENTER** to select segment 1 of 1.

```
TRANSIENT: PRGM #4   SEGMENT #1   OF 1
T=.0002    Va=108    Vb=108    Vc=108
F=400      WFa=1     WFb=1     WFc=1
```

Press **.0002 ENTER** to select a time .0002 seconds. This is the smallest time allowed for a time based transient.

```
TRANSIENT: PRGM #4   SEGMENT #1   OF 1
T=0.0002    Va=108    Vb=108    Vc=108
F=400      WFa=1     WFb=1     WFc=1
```

Press **80 ENTER 80 ENTER 80 ENTER** to select 80 volts on all three phases.

```
TRANSIENT: PRGM #4   SEGMENT #1   OF 1
T=0.0002    Va=80     Vb=80     Vc=80
F=400      WFa=1     WFb=1     WFc=1
```

4.4.2.1 TIME BASED TRANSIENT EXAMPLE (cont)

Press 400 ENTER to select 400 hertz output frequency.

```
TRANSIENT: PRGM #4    SEGMENT #1    OF 1
T=0.0002    Va=80     Vb=80      Vc=80
F=400      WFa=1     WFb=1      WFc=1
```

Press 1 ENTER 1 ENTER 1 to select WaveForm 1 on all three phases.

```
TRANSIENT: PRGM #4    SEGMENT #1    OF 1
T=0.0002    Va=80     Vb=80      Vc=80
F=400      WFa=1     WFb=1      WFc=1
```

Press ENTER, now we are starting segment 2 of 2.

```
TRANSIENT: PRGM #4    SEGMENT #2    OF 2
T=0.0002    Va=108    Vb=108     Vc=108
F=400      WFa=1     WFb=1      WFc=1
```

Press ENTER ENTER .01 ENTER to select default segment 2 of 2 and a time 10 milliseconds.

```
TRANSIENT: PRGM #4    SEGMENT #2    OF 2
T=.01       Va=108    Vb=108     Vc=108
F=400      WFa=1     WFb=1      WFc=1
```

4.4.2.1 TIME BASED TRANSIENT EXAMPLE (cont)

Press **80 ENTER 80 ENTER 80 ENTER** to select 80 volts on all three phases.

```
TRANSIENT: PRGM #4    SEGMENT #2    OF 2
T=0.01      Va=80      Vb=80      Vc=80
F=400      WFa=1      WFb=1      WFc=1
```

Press **400 ENTER** to select 400 hertz.

```
TRANSIENT: PRGM #4    SEGMENT #2    OF 2
T=0.01      Va=80      Vb=80      Vc=80
F=400      WFa=1      WFb=1      WFc=1
```

Press **1 ENTER 1 ENTER 1** to select WaveForm 1 on all three phases.

```
TRANSIENT: PRGM #4    SEGMENT #2    OF 2
T=0.01      Va=80      Vb=80      Vc=80
F=400      WFa=1      WFb=1      WFc=1
```

Press **ENTER**, now we are starting segment 3 of 3.

```
TRANSIENT: PRGM #4    SEGMENT #3    OF 3
T=0.01      Va=108     Vb=108     Vc=108
F=400      WFa=1      WFb=1      WFc=1
```

4.4.2.1 TIME BASED TRANSIENT EXAMPLE (cont)

Press **ENTER ENTER .07 ENTER** to select default segment 3 of 3 and a time 70 milliseconds.

```
TRANSIENT: PRGM #4   SEGMENT #3   OF 3
T=.07       Va=108    Vb=108    Vc=108
F=400      WFa=1     WFb=1     WFc=1
```

Press **108 ENTER 108 ENTER 108 ENTER** to select 108 volts on all three phases.

```
TRANSIENT: PRGM #4   SEGMENT #3   OF 3
T=0.07      Va=108    Vb=108    Vc=108
F=400      WFa=1     WFb=1     WFc=1
```

Press **400 ENTER** to select 400 hertz.

```
TRANSIENT: PRGM #4   SEGMENT #3   OF 3
T=0.07      Va=108    Vb=108    Vc=108
F=400      WFa=1     WFb=1     WFc=1
```

Press **1 ENTER 1 ENTER 1** to select WaveForm 1 on all three phases.

```
TRANSIENT: PRGM #4   SEGMENT #3   OF 3
T=0.07      Va=108    Vb=108    Vc=108
F=400      WFa=1     WFb=1     WFc=1
```

4.4.2.1 TIME BASED TRANSIENT EXAMPLE (cont)

Press **STORE** to save the transient.

```
TRANSIENT EVENTS:
ENTER # OF TRANSIENT EVENTS 1
0 FOR INFINITE OR 1-65535.
```

Press **1 STORE** to cause only one transient event.

```
V/I METER:
FREQ=400.0  Va=108.0  Vb=108.0  Vc=108.0
SENSE=INT  Vab=187.1 Vbc=187.1 Vca=187.1
MANUAL MODE Ia=00.0   Ib=00.0   Ic=00.0
```

If the UPC was previously executing program #4, it will now be in MANUAL MODE. This is because program #4 has changed. To execute the transient you must first execute program #4. Press **PROGRAM 4 ENTER EXECUTE** to execute the program.

```
V/I METER:
FREQ=400.0  Va=108.0  Vb=108.0  Vc=108.0
SENSE=INT  Vab=187.1 Vbc=187.1 Vca=187.1
PROGRAM #4  Ia=00.0   Ib=00.0   Ic=00.0
```

Press **TRANS** to execute the transient.

This is a MIL-STD-704D under voltage time based transient. See figure 4.4.2.1.

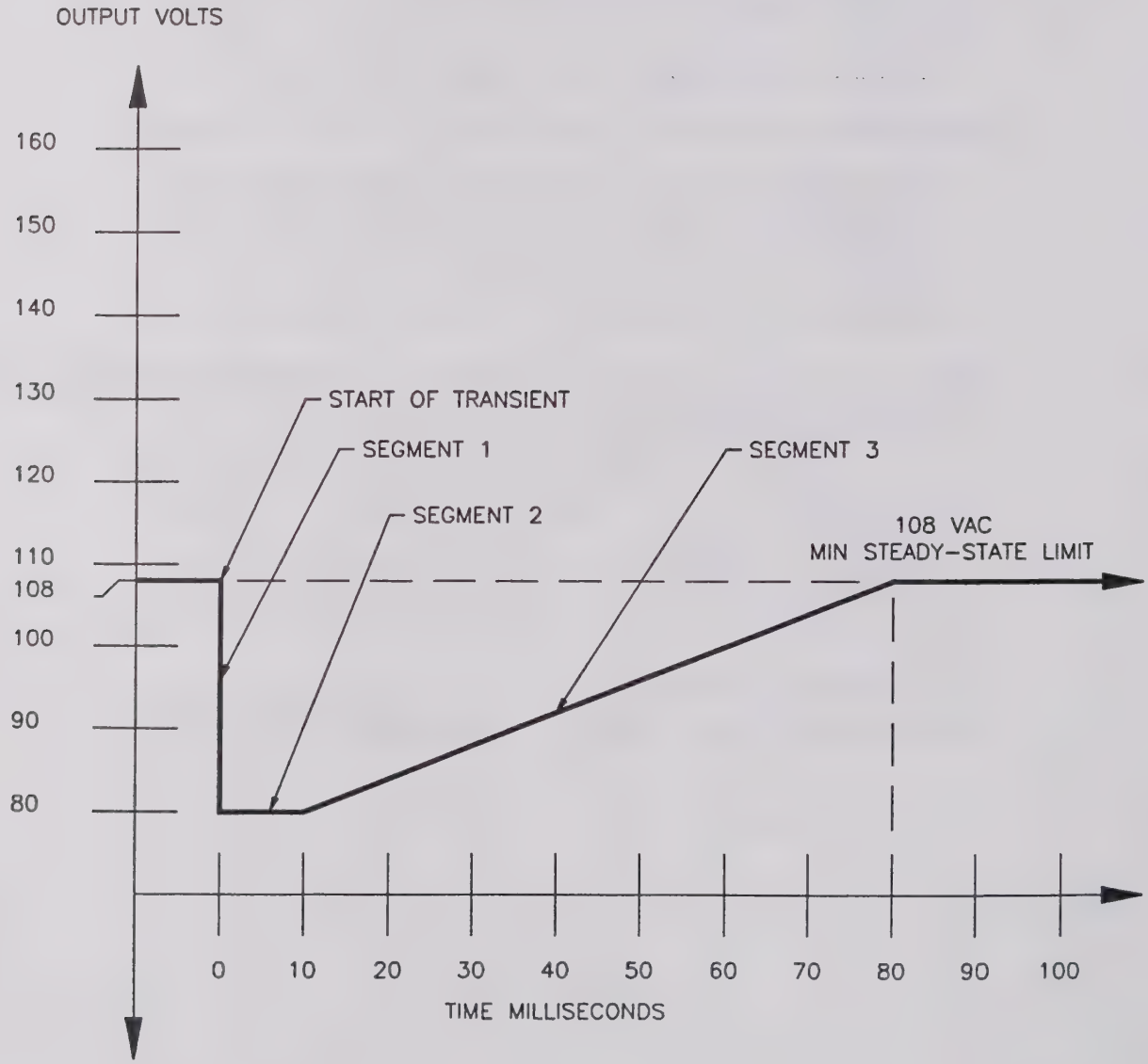


FIGURE 4.4.2.1 MIL-STD-704D UNDERVOLTAGE TRANSIENT

4.4.2.2 CYCLE BASED TRANSIENT EXAMPLE

The following is an example of how to create a cycle based transient. This example presumes the user has loaded the program information as described in the previous examples.

Start with program #4 example as shown in section 4.4.1.1. From any metering display press **PROGRAM 4 ENTER EDIT EDIT** and you should see the following display:

```
TRANSIENT: PRGM #4    SEGMENT #1    OF 1
T=0.0002     Va=108     Vb=108     Vc=108
F=400        WFa=1      WFb=1      WFc=1
```

Press **1 ENTER ENTER** to select segment 1 of 1.

```
TRANSIENT: PRGM #4    SEGMENT #1    OF 1
T=.0002      Va=108     Vb=108     Vc=108
F=400        WFa=1      WFb=1      WFc=1
```

Press **0 ENTER** to select a cycle based transient.

```
TRANSIENT: PRGM #4    SEGMENT #1    OF 1
T=1 CYCLE    Va=108     Vb=108     Vc=108
F=400        WFa=1      WFb=1      WFc=1
```

Press **122 ENTER 122 ENTER 122 ENTER** to enter 122 volts on all three phases. Note 122 volts is higher than the 108 volts of the steady-state program. This will cause the base sinewave to remain at a constant amplitude while adding extra voltage for the spikes.

```
TRANSIENT: PRGM #4    SEGMENT #1    OF 1
T=1 CYCLE    Va=122     Vb=122     Vc=122
F=400        WFa=1      WFb=1      WFc=1
```

4.4.2.2 CYCLE BASED TRANSIENT EXAMPLE (cont)

Press **400 ENTER** to select 400 hertz.

```
TRANSIENT: PRGM #4    SEGMENT #1    OF 1
T=1 CYCLE   Va=122     Vb=122     Vc=122
F=400      WFa=1      WFb=1      WFc=1
```

Press **15 ENTER 15 ENTER 15** to select waveform #15 on all three phases.

```
TRANSIENT: PRGM #4    SEGMENT #1    OF 1
T=1 CYCLE   Va=122     Vb=122     Vc=122
F=400      WFa=15     WFb=15     WFc=15
```

Press **STORE** to save the transient.

4.4.2.2 CYCLE BASED TRANSIENT EXAMPLE (cont)

```
TRANSIENT EVENTS:
ENTER # OF TRANSIENT EVENTS 1
0 FOR INFINITE OR 1-65535.
```

Press **1 STORE** to cause only one transient event.

```
V/I METER:
FREQ=400.0  Va=108.0  Vb=108.0  Vc=108.0
SENSE=INT  Vab=187.1 Vbc=187.1 Vca=187.1
MANUAL MODE Ia=00.0   Ib=00.0   Ic=00.0
```

If the UPC was previously executing program #4, it will now be in MANUAL MODE. This is because program #4 has changed. To execute the transient you must first execute program #4. Press **PROGRAM 4 ENTER EXECUTE** to execute the program.

```
V/I METER:
FREQ=400.0  Va=108.0  Vb=108.0  Vc=108.0
SENSE=INT  Vab=187.1 Vbc=187.1 Vca=187.1
PROGRAM #4  Ia=00.0   Ib=00.0   Ic=00.0
```

Press **TRANS** to execute the transient.

This cycle based transient will switch waveform #15 in for one cycle. This will cause a spike on the positive and negative half of the sinewave for one cycle. See figure 4.4.2.2.

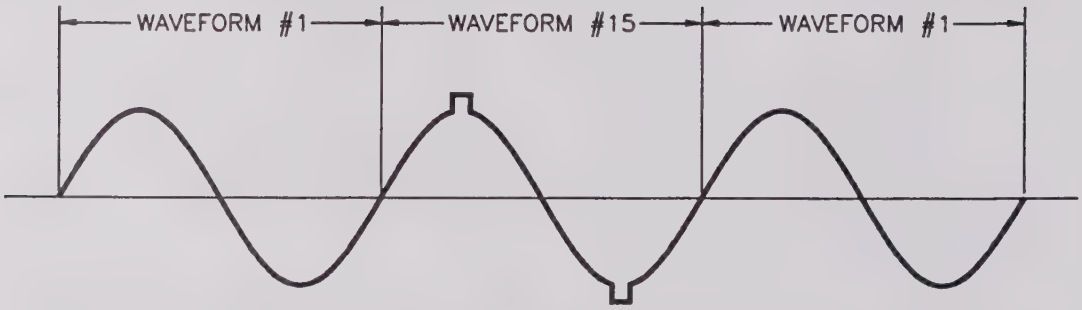


FIGURE 4.4.2.2 SPIKE TRANSIENT

4.5 SETUP MODE

SETUP MODE is used to copy and delete programs, erase memory, copy and edit waveforms. You may set meter sense point, set CSC on or off, set Output Impedance, set Output range, transition time, min and max frequency and LCD (view angle and backlight). Status is given for firmware version, GPIB device address or RS-232 SERIAL Interface parameters, transformer ratio, amps to volts ratio and the Power Source.

From any meter display, press the ***fn*** key to enter SETUP MODE.

```
SETUP: PRESS 1 FOR PROGRAM SETUP
             2 FOR WAVEFORM SETUP
             3 FOR GENERAL SETUP
             4 FOR CALIBRATION MENU.
```

4.5.1 PROGRAM SETUP

PROGRAM SETUP is used to copy and delete programs, erase memory, copy and edit waveforms.

From any METER display (V/I, AMPS or POWER), press the ***fn*** key to enter SETUP MODE. From the SETUP display, press **1** to enter PROGRAM SETUP.

```
PROGRAM SETUP: PRESS
1 TO COPY A PROGRAM,
2 TO DELETE A PROGRAM,
3 TO ERASE ALL MEMORY AND RESET CPU.
```

4.5.1.1 COPY PROGRAM

COPY PROGRAM is used to copy programs.

From any METER display (V/I, AMPS or POWER), press the ***fn*** key to enter SETUP MODE.
From the SETUP display, press **1** to enter PROGRAM SETUP.
From the PROGRAM SETUP display, press **1** to enter COPY PROGRAM.

```
COPY PROGRAM:                          RANGE
SOURCE PROGRAM NUMBER=1                0-103
DESTINATION PROGRAM NUMBER=2           1-99
PRESS STORE TO COPY.
```

SOURCE PROGRAM NUMBER

0 will copy the MANUAL MODE operating parameters.

1-99 are user created programs that may be edited or copied to and from.

Program **100** is a MIL-STD-704D overvoltage transient. Program **101** is a MIL-STD-704D undervoltage transient. Program **102** is a MIL-STD-704D over-frequency transient. Program **103** is a MIL-STD-704D under-frequency transient. These programs may be copied to any of programs **1 - 99** and executed.

DESTINATION PROGRAM NUMBER

1-99 are user created programs that may be edited or copied to and from.

4.5.1.2 DELETE PROGRAM

DELETE PROGRAM is used to delete programs. This is useful to free up memory.

From any METER display (V/I, AMPS or POWER), press the ***fn*** key to enter SETUP MODE.
From the SETUP display, press **1** to enter PROGRAM SETUP.
From the PROGRAM SETUP display, press **2** to enter DELETE PROGRAM.

```
DELETE PROGRAM:                        RANGE
PROGRAM TO DELETE=1                    1-99
PRESS STORE TO ERASE.
```

4.5.1.3 ERASE ALL RAM AND RESET CPU

ERASE ALL RAM AND RESET CPU is used to erase edited programs 1-99 and edited waveforms 2-16. This will reset everything in the UPC. Only do this if the UPC is acting abnormally or if it is desired to restore all factory default settings. This must also be performed if the UPC firmware (EPROMS) have been changed.

From any METER display (V/I, AMPS or POWER), press the ***fn*** key to enter SETUP MODE.
From the SETUP display, press **1** to enter PROGRAM SETUP.
From the PROGRAM SETUP display, press **3** to enter ERASE ALL RAM AND RESET CPU.

```
ERASE ALL RAM AND RESET CPU:
WARNING-THIS WILL ERASE ALL PROGRAMS AND
EDITED WAVEFORMS. PRESS EXECUTE TO
ERASE RAM AND RESET CPU.
```

Press **EXECUTE** to perform this action.

NOTE: Pressing **9** instead of **EXECUTE** will cause the UPC to reset without clearing RAM.

An alternative to the above method is to hold down the **CLEAR** key while applying INPUT POWER to the UPC. This will clear ALL RAM and RESET the CPU.

4.5.2 WAVEFORM SETUP

WAVEFORM SETUP is used to copy and edit waveforms. The output contactor enable must be off before you can change a waveform.

From any METER display (V/I, AMPS or POWER), press the ***fn*** key to enter SETUP MODE.
From the SETUP display, press **2** to enter WAVEFORM SETUP.

```
WAVEFORM SETUP: PRESS
1 TO EDIT A WAVEFORM,
2 TO COPY A WAVEFORM.
3 FOR WAVEFORM SYNTHESIS
```

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4.5.2.1 EDIT WAVEFORM

EDIT WAVEFORM is used to change or modify waveforms.

From any METER display (V/I, AMPS or POWER), press the ***fn*** key to enter SETUP MODE.
From the SETUP display, press **2** to enter WAVEFORM SETUP.
From the WAVEFORM SETUP display, press **1** to enter EDIT WAVEFORM.

```
EDIT WAVEFORM: NUMBER=16      RANGE=2-16
STARTING PHASE ANGLE=0         0-359.5°
ENDING PHASE ANGLE  =0         0-359.5°
VOLTAGE IN PERCENT =-100      (+/-)0-100%
```

Press EXECUTE to save the new waveform. This will cause the UPC to stop generating any output while the new waveform is being generated.

NUMBER — **2-16** may be edited.

PHASE ANGLE — The STARTING AND ENDING PHASE ANGLE determine what portion of the waveform is being edited.

VOLTAGE IN PERCENT — All points on the waveform from the starting to ending phase angle will change to this new voltage. This voltage is entered in percent, relative to the peak of the waveform, and may be positive or negative.

WAVEFORM RMS CONTENT — The UPC will attempt to generate the selected waveform at the rms voltage programmed. Because of the difference in the rms voltage content of various waveforms the UPC may not be able to reproduce the waveform at the voltage desired. Selecting transformer coupled output with a high ratio may solve this problem.

Basic sinusoidal waveforms with large dropouts or spikes will change the rms content of the waveform. The UPC will cause the basic sinewave to change in amplitude in order to keep the correct rms voltage. If you wish to keep the basic sinewave at the same amplitude and add a large dropout, you must also program a lower rms voltage. If you wish to keep the basic sinewave at the same amplitude and add a large spike, you must also program a larger rms voltage.

4.5.2.1 EDIT WAVEFORM (cont)

For example if you wanted to put a 10% spike on top of a sinewave, first copy waveform 1 to waveform 2 at a 90% amplitude scale factor. See the example in section 4.5.2.2 copy waveform. This will give you 10% more voltage at the peak of the sinewave to work with. Then you may edit waveform 2 and add a 10% spike.

From the WAVEFORM SETUP display, press 1 to enter EDIT WAVEFORM.

```
EDIT WAVEFORM: NUMBER=2          RANGE=2-16
STARTING PHASE ANGLE=0           0-359.5°
ENDING PHASE ANGLE  =0           0-359.5°
VOLTAGE IN PERCENT =-100        (+/-)0-100%
```

Press **2 ENTER** to select waveform 2.

```
EDIT WAVEFORM: NUMBER=2          RANGE=2-16
STARTING PHASE ANGLE=0           0-359.5°
ENDING PHASE ANGLE  =0           0-359.5°
VOLTAGE IN PERCENT =100         (+/-)0-100%
```

Press **85 ENTER** to select the start angle.

```
EDIT WAVEFORM: NUMBER=2          RANGE=2-16
STARTING PHASE ANGLE=85          0-359.5°
ENDING PHASE ANGLE  =0           0-359.5°
VOLTAGE IN PERCENT =100         (+/-)0-100%
```

Press **95 ENTER** to select the end angle.

```
EDIT WAVEFORM: NUMBER=2          RANGE=2-16
STARTING PHASE ANGLE=85          0-359.5°
ENDING PHASE ANGLE  =95          0-359.5°
VOLTAGE IN PERCENT =100         (+/-)0-100%
```

4.5.2.1 EDIT WAVEFORM (cont)

Press 100 to select the peak voltage in percent of full scale from the starting to ending phase angles.

```
EDIT WAVEFORM: NUMBER=2          RANGE=2-16
STARTING PHASE ANGLE=85          0-359.5°
ENDING PHASE ANGLE  =95          0-359.5°
VOLTAGE IN PERCENT =100        (+/-)0-100%
```

Press EXECUTE to save the new waveform. This will cause the UPC to temporarily stop producing any output signal while the new waveform is being processed internally in the UPC.

Make a new program with Waveform 2 and execute the new program. You should see the waveform as shown in figure 4.5.2.1.

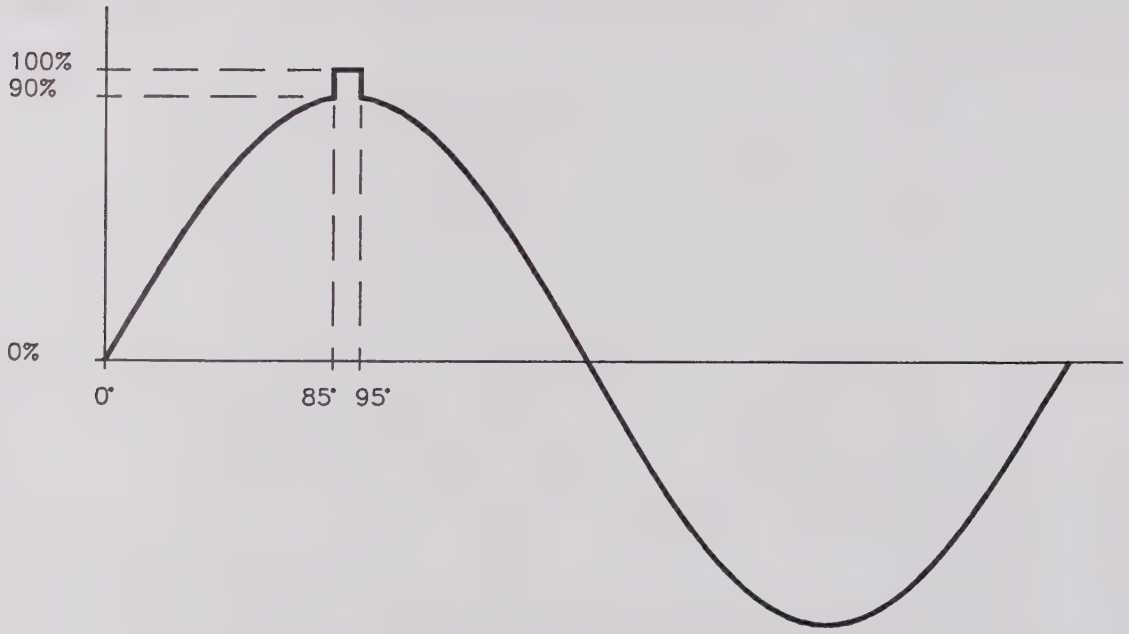

FIGURE 4.5.2.1 EDITED WAVEFORM

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4.5.2.2 COPY WAVEFORM

COPY WAVEFORM is used to copy waveforms.

From any METER display (V/I, AMPS or POWER), press the ***fn*** key to enter SETUP MODE.
From the SETUP display, press **2** to enter WAVEFORM SETUP.
From the WAVEFORM SETUP display, press **2** to enter COPY WAVEFORM.

```
COPY WAVEFORM:                          RANGE
AMPLITUDE SCALE FACTOR=100              0-100%
SOURCE WAVEFORM          =1             1-99
DESTINATION WAVEFORM     =2             2-16
```

Press EXECUTE to copy the waveform. This will cause the UPC to stop generating any output while the waveform is being copied.

AMPLITUDE SCALE FACTOR — Sets the amplitude of the destination waveform relative to the source waveform.

SOURCE WAVEFORM — **1-99** may be copied from. **1** is always a sinewave. **2-16** may be edited. **17-99** are permanently stored and cannot change.

DESTINATION WAVEFORM — **2-16** may be copied to.

4.5.2.2 COPY WAVEFORM (cont)

For example if you wanted to put a 10% spike on top of a sinewave, first copy waveform 1 to waveform 2 at a 90% amplitude scale factor. This will give you 10% more voltage at the peak of the sinewave to work with. Then you may edit waveform 2 and add a 10% spike.

From the WAVEFORM SETUP display, press **2** to enter COPY WAVEFORM.

```
COPY WAVEFORM:                          RANGE
AMPLITUDE SCALE FACTOR=100              0-100%
SOURCE WAVEFORM          =1             1-99
DESTINATION WAVEFORM     =2             2-16
```

Press **90 ENTER 1 ENTER 2** to select amplitude scale factor, source and destination waveforms.

```
COPY WAVEFORM:                          RANGE
AMPLITUDE SCALE FACTOR=90               0-100%
SOURCE WAVEFORM          =1             1-99
DESTINATION WAVEFORM     =2             2-16
```

Press **EXECUTE** to copy the waveform. This will cause the UPC to stop generating any output while the waveform is being copied. Waveform 2 is now a sinewave but at 90% of the amplitude of waveform 1.

4.5.2.3 WAVEFORM SYNTHESIS

WAVEFORM SYNTHESIS is used to create waveforms from Harmonic magnitude and phase angle information.

From any METER display (V/I, AMPS or POWER), press the ***fn*** key to enter SETUP MODE.
From the SETUP display, press **2** to enter WAVEFORM SETUP.
From the WAVEFORM SETUP display, press **3** to enter WAVEFORM SYNTHESIS.

The following is displayed.

```
WAVEFORM SYNTHESIS: WAVEFORM #2
HARMONIC: 2nd  3rd  4th  5th  6th
CONTENT:  .1%  0%   0%   0%   0%
φANGLE:   0°   0°   0°   0°   0°
```

Note: The CONTENT fields hold the Magnitude values.

The first step in creating a waveform from Harmonic data is to specify the Waveform number that will hold the newly created waveform. After entering the waveform number, enter each harmonic magnitude and its phase angle. Harmonics up to the 51st may be entered.

The waveform is synthesized using a sine series with coefficients expressed in polar format, ie. that is magnitude and phase angle.

Each magnitude percentage is referenced to the fundamental which is always defined as having a magnitude of 100%.

When all desired harmonic data has been entered, press the **EXECUTE** key. The waveform previously stored in the specified Waveform location # is overwritten. Programs referring to this waveform # are affected.

The **STORE** key may be used to store the data entered so far, without calculating and producing the new waveform.

4.5.3 GENERAL SETUP

GENERAL SETUP is used for UPC SETUP, LCD SETUP, UPC STATUS and POWER SOURCE STATUS.

From any METER display (V/I, AMPS or POWER), press the ***fn*** key to enter SETUP MODE. From the SETUP display, press **3** to enter GENERAL SETUP.

```
GENERAL SETUP: PRESS
1 FOR UPC SETUP,  2 FOR LCD SETUP,
3 FOR UPC STATUS, 4 FOR PWR SOURCE STATS
5 FOR RANGE CTRL, 6 FOR SLEW RATE SETUP.
```

The following pages describe each menu item shown above.

4.5.3.1 UPC SETUP

UPC SETUP is used to select meter sense point, enable or disable automatic level control, set the optional Programmable Output Impedance, set transition time and frequency limits.

From any METER display (V/I, AMPS or POWER), press the ***fn*** key to enter SETUP MODE.
From the SETUP display, press **3** to enter GENERAL SETUP.
From the GENERAL SETUP display, press **1** to enter UPC SETUP.

```
UPC SETUP: SENSE=INT, CSC=OFF
PROG.Zo-Hit EDIT. TRANSITION TIME=0
FREQ.   LIMITS MIN=45     MAX=5000
VOLTAGE LIMITS MIN=0      MAX=600
```

SENSE	May be **INT**ernal or **EXT**ernal. This is the sense point for metering and CSC. **EXT**ernal uses the remote sense terminals on the rear panel of the Power Source.
CSC	Continuous Self Calibration. If EXTernal SENSE is selected, CSC may be used to compensate for output wiring losses and maintain accurate program output voltage at the sense point which may be the load.
PROG. Zo	(Programmable Output Impedance) is used to compensate for regulation loss due to transformer outputs or to control the Output Impedance of the power source. Press **EDIT** to access the PROG. Zo menu, as shown below.
TRANSITION TIME	If a new program is executed, or changes are made in MANUAL MODE (or in REMOTE CONTROL), it will take this long for the UPC to transition from the current voltages and frequency to the new voltages and frequency. This feature may be used when it is undesirable to cause abrupt changes to the output power signal. This feature does not affect transient operation. This parameter may be set from 0 to 300 seconds in 200 uS steps. Waveforms are switched at the <u>end</u> of the Transition.
FREQ LIMITS	Sets the MINimum and MAXimum programmable frequency limits of the UPC.
VOLTAGE LIMITS	Sets the MINimum and MAXimum programmable voltage limits of the UPC.

4.5.3.1.1 PROGRAMMABLE OUTPUT IMPEDANCE SETUP MENUS

Programmable Output Impedance (Prog. Zo) is used to compensate for regulation loss due to transformer outputs or to control the Output Impedance of the power source. Press **EDIT** while the display cursor is located in the PROG. Zo field in the UPC SETUP menu to access the PROG. Zo menu, as shown below.

```
PROG. Zo SETUP: PRESS EXECUTE TO SAVE.
PROG. Zo = OFF: PROG. Zo OHMS = 0.000
                MAX=2.516   MIN=-2.484
(PRESS EDIT TO CALIBRATE, THEN EXECUTE)
```

Pressing the +/- key while the cursor is in the ON/OFF field will enable/disable the Prog. Zo function. When disabled, no output compensation occurs and the inherent output impedance of the power source and wiring will remain uncompensated. When enabled, the UPC will attempt to provide an output impedance at the load equal to the value set in the PROG. Zo OHMS field.

Min and max impedance values are shown on the display as this range dynamically changes based upon current operating parameters such as Form, Coupling and XFMR ratio. Press EXECUTE to exit the screen.

- - - C A U T I O N - - -

CARELESS OR IMPROPER USE
OF THE
PROGRAMMABLE OUTPUT IMPEDANCE FUNCTION
MAY RESULT IN OVER-VOLTAGE OR UNDER-VOLTAGE BEING PRESENTED
TO THE LOAD, AND CAUSE DAMAGE TO THE LOAD.

REACTIVE LOADS MAY CAUSE THE OUTPUT POWER TO BECOME UNSTABLE (OSCILLATE)
AND CAUSE DAMAGE TO THE LOAD
IF EXCESSIVE NEGATIVE IMPEDANCE IS USED!

USE THIS FUNCTION WITH CARE

- - - C A U T I O N - - -

4.5.3.1.1 PROGRAMMABLE OUTPUT IMPEDANCE SETUP MENUS (cont)

Press **EDIT** again to access the following screens to enter special calibration values for the Prog. Zo function.

ϕ	Z direct	XFMR ratio	Z xfmr
1	0.006	1.5	0.450
2	0.032	2.0	1.400
3	0.016	2.5	2.970

NOTE: The unit is pre-calibrated at the factory, but if re-calibration of this function is desired, or if the RAM (memory) in the UPC has been lost or erased, use this screen to enter new calibration values. A calibration procedure is listed below.

The ϕ column indicates the Power Form of operation (1,2 or 3 phase).

The Z direct column accepts the Direct coupled impedance of the power source (per phase) for the given Power Form listed on the far left. During DIRECT coupled operation, the proper Z direct value is used to calibrate the PROG. Zo function based upon the Power Form selected in the Program being executed.

The XFMR ratio column accepts up to 3 separate XFMR ratios. Typically only one will be entered.

The Z xfmr column accepts the the impedances of the XFMR listed in the XFMR ratio column. During XFMR coupled operation, the proper Z xfmr value is used to calibrate the PROG. Zo function based upon the XFMR ratio selected in the Program being executed.

Calibration values for Direct coupled operation may be established via the following procedure.

1. Turn CSC OFF. Disable PROG. Zo. Execute a program in Direct coupled mode.

   A. Establish the difference in output voltage between no-load and full-load voltage.
   B. Divide the Voltage difference by the full-load current. The net result is the inherent direct coupled impedance of the power source.

$$Z = \frac{V_no_load - V_full_load}{I_full_load}$$

   Use the result to enter in as Z-Direct for the power form used to perform this test.

2. Calibration values for XFMR coupled operation may be established via the above procedure, except the Z direct value must be subtracted from the Z XFMR calculation prior to entering the Z XFMR value into the UPC. The DC resistance of each XFMR secondary tap may also be entered in for Z XFMR as an alternative to using the above procedure for measuring XFMR impedance. NOTE: XFMR impedances may vary greatly with temperature.

4.5.3.2 LIQUID CRYSTAL DISPLAY SETUP

LIQUID CRYSTAL DISPLAY SETUP is used to set the view angle and back light of the display.

From any METER display (V/I, AMPS or POWER), press the ***fn*** key to enter SETUP MODE.
From the SETUP display, press **3** to enter GENERAL SETUP.
From the GENERAL SETUP display, press **2** to enter LIQUID CRYSTAL DISPLAY SETUP.

```
LIQUID CRYSTAL DISPLAY SETUP: PRESS
1 FOR VIEW ANGLE,
2 FOR BACK LIGHT,
THEN ARROWS TO ADJUST.
```

VIEW ANGLE	Press **1** then use the arrow keys to adjust the view angle of the LCD as desired.
BACK LIGHT	Press **2** then use the arrow keys to adjust the back light of the LCD as desired.

4.5.3.3 UPC STATUS

UPC STATUS indicates firmware version, GPIB or RS-232 SERIAL interface status, and DIP switch settings. It also allows the user to set the GPIB device address. See section 10 if the RS-232 SERIAL REMOTE INTERFACE is installed. The UPC SETUP menu is accessed from the General Setup menu (*fn*,3,1).

From any METER display (V/I, AMPS or POWER), press the ***fn*** key to enter SETUP MODE.
From the SETUP display, press **3** to enter GENERAL SETUP.
From the GENERAL SETUP display, press **3** to enter UPC STATUS.

```
UPC STATUS: FIRMWARE VERSION 2.0
GPIB ADDRESS 1  IFC     LAST DATA BYTE=00h
TRANSFORMER RATIO 2.0.
AMPS TO VOLTS RATIO 5  A=1 V.
```

GPIB ADDRESS — This is the IEEE-488 device address for the UPC. To change the address, press **EDIT**, enter a number from 0 to 30 then press **ENTER** or **STORE**. The factory default address is 1.

TRANSFORMER RATIO — This is the output Transformer Ratio of the Power Source. To change this see section 3.4.1 CONFIGURE TRANSFORMER RATIO.

AMPS TO VOLTS RATIO — This sets the ratio of current to voltage which the UPC meters. To change this see section 3.4.2 CONFIGURE AMPS TO VOLTS RATIO.

IFC — This is displayed only if an IEEE-488 Interface Clear message is received while this status display is shown. This display latches the IFC message. Press **CLEAR** to clear this display and the IFC field. This is used for troubleshooting the GPIB interface.

LAST DATA BYTE = — This field indicates the last data byte (DAB) received by the devices GPIB interface. The byte is shown in hexadecimal format. Hex 0D (Carriage Return) is displayed as Hex 0A (New Line). This is used for troubleshooting the GPIB interface.

4.5.3.4 POWER SOURCE STATUS

POWER SOURCE STATUS indicates the state of control signals to and from the Power Source that are not indicated by leds on the front panel. See sections 2.3.4 OUTPUT CONTROL and 2.3.5 INPUT CONTROL for a description of these signals. This display is only used for technical diagnostics.

From any METER display (V/I, AMPS or POWER), press the ***fn*** key to enter SETUP MODE.
From the SETUP display, press **3** to enter GENERAL SETUP.
From the GENERAL SETUP display, press **4** to enter POWER SOURCE STATUS.

```
POWER SOURCE STATUS:
          3PH     1PH    CONNECTOR     XFMR
CMD     FALSE   FALSE      FALSE       FALSE
CONF    FALSE   FALSE      FALSE       FALSE
```

CMD Are Commands signals sent from the UPC to the Power Source.

CONF Are Confirmations signals sent from the Power Source to the UPC.

Pressing the +/- key toggles the Connector CMD signal state.

4.5.3.5 RANGE CONTROL

Some power source models support Range Control to achieve maximum efficiency. The UPC allows selection of Range Control parameters even when it is not supported by the attached power source. In this case the following screens have no effect. The RANGE CONTROL SETUP menu is accessed from the General Setup menu (*fn*,3,5).

There are 2 modes of operation for Range Control. AUTO and MANUAL. AUTO is the default mode. Pressing the +/- key when the cursor is in the MODE field toggles between AUTO and MANUAL modes. When MANUAL mode is selected, an OUTPUT RANGE may be selected. As of printing date of this manual, the following ranges are applicable.

PROGRAMMED OUTPUT AC VOLTS	RANGE #
< 110	1
110 - 120.9	2
121 - 130.9	3
> 131	4

Press EXECUTE to save the parameter entries.

```
RANGE CONTROL MODE: MANUAL
SELECT OUTPUT RANGE: 1
```

NOTE: The above Output voltages are for Single phase operation. If split (2) phase operation is used, the above Output voltage ranges are doubled.

4.5.3.6 SLEW RATE SETUP

Selecting SLEW RATE SETUP from the General Setup menu (*fn*,3,6) allows the slewing functions to slew at a predetermined rate. Defaults values are 1 volt per second and 1 Hz. per second. Press EXECUTE to save the parameter entries.

```
SLEW RATE SETUP:
VOLTS / SEC. = 1
HERTZ / SEC. = 1
```

NOTE: Slew rates are approximate.

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SECTION 5

GPIB and REMOTE OPERATION

5 GPIB and REMOTE OPERATION

This section describes remote control functions of the UPC over the IEEE-488 BUS or RS-232 SERIAL REMOTE Interface. It is strongly recommended that the user read Section 4 (Front Panel Operation) to become familiar with the capabilities of the UPC. Section 5 expects the user to have already gained an understanding of the UPC's capabilities.

Most commands listed in this section are also used with the optional RS-232 Serial Remote Interface. See section 10 for detailed information on the RS-232 Remote Interface.

5.1 INTRODUCTION

REMOTE CONTROL is established when a controlling or programming command is sent to the UPC by the Bus controller with REN (remote enable) set true. THe REN line on the bus interface must be kept true to maintain REMOTE CONTROL. REMOTE CONTROL can only be initiated and maintained while the UPC is displaying a Metering display (not while editing) or while in the UPC STATUS display. All front panel programming and signal controls are disabled while REMOTE CONTROL is active, but metering information is still accessible for viewing through the front panel.

Status and metered data queries do not place the UPC into REMOTE CONTROL.

The front panel **LOCAL** key allows the user to restore LOCAL CONTROL unless the Bus controller has sent the IEEE-488 LOCAL LOCKOUT (LLO) message. The Bus controller may restore LOCAL CONTROL by sending the IEEE-488 GOTO LOCAL (GTL) message. Refer to section 4.5.3.3 for setting the GPIB device address.

NOTE: Contact PPSC for availability of Instrument drivers for use with **National Instruments LabWindows, LabView** and **LabView for Windows.** These software drivers allow graphical programming and control of the UPC via the REMOTE interface. These drivers may support the IBM-PC, Macintosh and SUN computers. Software drivers for other programming languages may also be made available.

5.2 CONVENTIONS

1. COMMANDS are shown in the left hand column beginning with asterisk (*) or colon (:) in **BOLD** text with NO underline.

2. Command DESCRIPTIONS are shown in the right hand column.

3. Refer to the SCPI 1992 standard for more information. SCPI is "Standard Commands for Programmable Instruments -1992". This standard is available from the SCPI Consortium, 8380 Hercules Dr. Suite P3, La Mesa Ca. 91942.

4. Some SCPI keywords are optional, and are ignored by the device. Optional keywords are enclosed in [] brackets.

5. Lowercase letters of commands shown are optional.

6. SCPI commands (start with :) recognized by the UPC , are NOT case sensitive, as opposed to the SCPI 1992 standard requiring uppercase letters in SCPI commands to remain uppercase.

7. IEEE-488.2 commands start with * and are not case sensitive.

8. All SCPI commands have query command counterparts unless noted. A query command consists of the command immediately appended with a question mark (?). No value is to be sent with a query. IEEE-488.2 commands do not have query counterparts unless explicitly shown with a question mark appended.

9. All required Functional Elements for devices are implemented. Refer to IEEE-488.2 section 4.3.1 for more information.

10. Refer to the ANSI/IEEE-488.1 1987 and ANSI/IEEE-488.2 1987 standards for more information. These standards are available from the IEEE Standards Board, 445 Hoes Ln. PO Box 1331 Piscataway, NJ 08855-1331.

11. Voltage and Waveform parameter names without a channel number suffix (1,2,3) may be used to set all 3 channels (phases) as an alternative to setting each separately to the same value.

12. All numerical values are ASCII encoded decimal strings consisting of 1 or more ASCII digits. 8 and 15 bit register values are binary weighted values represented by an ASCII string of 1 or more decimal digits. One exception, the Serial Poll byte, is an 8 bit hexadecimal byte.

5.2 CONVENTIONS (cont)

13. Multiple Commands and Queries may be sent in one Program Message but each must be separated by a semicolon ;. The term 'Program Message' refers to 1 or more commands and/or queries sent to the UPC as one continuous string and is not to be confused with Stored Programs within the UPC.

14. Multiple data parameter names and values must be separated by commas.

15. 'Multiple keyword' messages may be sent without duplicating the first level SCPI keyword (ie; SOURce).
Eg; **:SOURce:VOLTage1,120; VOLTage2,120; VOLTage3,120.**
A keyword is a single word beginning with a colon (:).

16. Program Messages MUST be terminated with a LINE FEED (0Ahex, 10dec) or END (EOI) signal. This is referred to as an end of string <eos>. A Carriage Return character (0Dhex, 13dec) is converted to a LINE FEED by the UPC. Further SCPI commands shall begin with a first level keyword (ie; **:SOURce:**).

17. All values shown in angle brackets < > are examples of real values used with commands but labels are sometimes used to indicate a variable which is not known until actual time of use. Eg; <AMPS meter range> might actually be <50>.

    Units such as AAC, Hz or % shown after the angle bracketed value is not to be included inside the value, but is shown as a reference to units. The angle brackets are not part of the value.

18. The UPC's input buffer is 8k bytes as is it's output buffer. No program message may exceed this length.

19. **:SOURce:** FORM, COUPling, VOLTage, FREQuency, CURRent:LIMit, PHASe and WAVEFORM values may be read by performing a query of PROGram 0. See examples. PROGram 0 contains the MANUAL MODE parameters. Sending **:SOURce:** commands invokes MANUAL MODE and REMOTE CONTROL.

20. The command strings may contain spaces.

21. The UPC interface accepts the IEEE-488.2 NR1, NR2 and NR3 numeric formats. Most query responses are NR1 or NR2 types. ie; NR1 = 120, NR2 = 120.0, NR3 = 1.2E+02.

5.3 PROGRAM CONTROL

:PROGram:NAME <nn> selects Program nn for loading. Range of nn is <0> to <99>. No query for this command.

:PROGram[:SELected]:DEFine <program>

defines program nn. Program nn consists of steady-state and optional transient segment parameter names and values. All program parameters are defined in the following sections.

NOTE: Only commas may separate the values, NO Carriage Returns or Line Feeds may separate the values.

Query returns steady-state values of selected program and segment values of most recently selected segment. "LAST" is returned with segment data if the segment is the last segment in the program.

STEADY-STATE OUTPUT PARAMETERS

FORM,<n>,
COUPLing,<s>,
XFMRRATIO,<n.n>,
FREQuency,<n>,
VOLTage,<n>, see Convention #11.
VOLTage1,<n>,
VOLTage2,<n>,
VOLTage3,<n>,
CURRent:LIMit<n>,
PHASe2,<n>,
PHASe3,<n>,
WAVEFORM,<n>, see Convention #11.
WAVEFORM1,<n>,
WAVEFORM2,<n>,
WAVEFORM3,<n>,
EVENTS,<n>,

5.3 PROGRAM CONTROL (cont)

TRANSIENT SEGMENT PARAMETERS (OPTIONAL)

SEGment,<n>,	
FSEG,<n>,	
VSEG,<n>,	see Convention #11.
VSEG1,<n>,	
VSEG2,<n>,	
VSEG3,<n>,	
WFSEG,<n>	see Convention #11.
WFSEG1,<n>,	
WFSEG2,<n>,	
WFSEG3,<n>,	
TSEG,<n>,	
LAST	Sent only if this is the LAST segment.

NOTE: Only 1 segment per Program Message may be sent.

5.3.1 STEADY-STATE OUTPUT PARAMETERS

FORM,<n>	sets Output Power Form of selected program. Values for n are <1>Single ϕ, <2>Split ϕ, or <3>Three ϕ.
COUPLing,<s>	sets Output coupling of selected program. Values for s are <DIRECT> or <XFMR>.
XFMRRATIO,<n.n>	sets Output XFMR ratio (n.n:1) of selected program. Range of n.n is <0.1> to <2.5>.
FREQuency,<n>	sets Output Frequency of selected program. Range of n is <20.00> to <5000> Hz.
VOLTage,<n>	sets Output VOLTAGE ϕA,B,C of selected program. Range of n is <0> to <150, or 136.5 x XFMRRATIO> Volts.
VOLTage1,<n>	sets Output VOLTAGE ϕA of selected program. Range of n is <0> to <150, or 136.5 x XFMRRATIO> Volts.
VOLTage2,<n>	sets Output VOLTAGE ϕB of selected program. Range of n is <0> to <150, or 136.5 x XFMRRATIO> Volts.
VOLTage3,<n>	sets Output VOLTAGE ϕC of selected program. Range of n is <0> to <150, or 136.5 x XFMRRATIO> Volts.
CURRent:LIMit <n>	sets Output Current Limit of selected program. Range of n is <0> to <AMPS meter range> Amps.

5.3.1 STEADY-STATE OUTPUT PARAMETERS (cont)

PHASe2,<n>	sets Output ϕ angle B of selected program. Range of n is <0> to <359> degrees.
PHASe3,<n>	sets Output ϕ angle C of selected program. Range of n is <0> to <359> degrees.
WAVEFORM,<n>	sets Output Waveform ϕA,B,C of selected program. Range of n is <1> to <16>.
WAVEFORM1,<n>	sets Output Waveform ϕA of selected program. Range of n is <1> to <16>.
WAVEFORM2,<n>	sets Output Waveform ϕB of selected program. Range of n is <1> to <16>.
WAVEFORM3,<n>	sets Output Waveform ϕC of selected program. Range of n is <1> to <16>.
EVENTS <n>	sets number of times to repeats the transient portion of the selected program when the Transient is executed. Range of n is 0-65535. A value of 0 indicates an infinite number.

5.3.2 TRANSIENT SEGMENT PARAMETERS

SEGment,<n>	selects segment n of selected program to be programmed. Range of n is <1> to <100>.
FSEG,<n>	sets objective Frequency of selected segment. Range of n is <20.00> to <5000> Hz.
VSEG,<n>	sets objective voltage ϕA,ϕB,ϕC of selected segment. Range of n is <0> to <150, or 136.5 x XFMRRATIO> Volts.
VSEG1,<n>	sets objective voltage ϕA of selected segment. Range of n is <0> to <150, or 136.5 x XFMRRATIO> Volts.
VSEG2,<n>	sets objective voltage ϕB of selected segment. Range of n is <0> to <150, or 136.5 x XFMRRATIO> Volts.
VSEG3,<n>	sets objective voltage ϕC of selected segment. Range of n is <0> to <150, or 136.5 x XFMRRATIO> Volts.
WFSEG1,<n>	sets Waveform ϕA of selected segment. Range of n is <1> to <16>.
WFSEG2,<n>	sets Waveform ϕB of selected segment. Range of n is <1> to <16>.
WFSEG3,<n>	sets Waveform ϕC of selected segment. Range of n is <1> to <16>.
TSEG,<n>	sets execution time (to reach objective Voltage and Frequency) of selected segment. Range of n is <0> or <.0002> to <300> seconds. Setting n to <0> selects cycle-based transient operation, ie; each segment time is equal to the period of 1 cycle (1/FREQ).
LAST	sets selected segment to be the last segment of selected program.

5.3.3 PROGRAM MEMORY CONTROL

:PROGram:[SELected:]DELete	deletes selected program. No query.
:PROGram:DELete:ALL	deletes all programs, performs a device reset, loads Program #1 with *RST values and executes manual mode with *RST values. Waveforms (1-16) are re-loaded from ROM. Externally referenced Calibration values are also deleted.

5.4 SIGNAL CONTROL

5.4.1 OUTPUT PARAMETERS

:PROGram:EXECute	Executes Program nn steady-state values. Range of nn is <0> to <99>. Program nn becomes selected program.
:PROGram:EXECute:TRANS	Executes pre-processed Transient portion of selected Program. Pre-processing is performed by executing a program. Transient terminates upon receipt of any data byte (DAB) from the IEEE-488 Bus, Device Clear, or when the LAST segment of the last EVENT is executed. Steady-state values are then restored. Immediately follow this command (in the same Program Message) with *OPC to detect the termination of the Transient events. An SRQ will occur when the Transient is completed (if the ESB bit is set in the SRE and the opc bit is set in the ESE. *OPC? may also be used in the same manner. No query.
*TRG	Same as :PROGram:EXECute:TRANS.
:[SOURce:]VOLTage <n>	sets Output VOLTAGE of all available Phases. Range of n is <0> to <150, or 136.5 x XFMRRATIO> Volts. See note 19 for query method.
:[SOURce:]VOLTage1 <n>	sets Output VOLTAGE ϕA. Range of n is <0> to <150, or 136.5 x XFMRRATIO> Volts. See note 19 for query method.
:[SOURce:]VOLTage2 <n>	sets Output VOLTAGE ϕB. Range of n is <0> to <150, or 136.5 x XFMRRATIO> Volts. See note 19 for query method.
:[SOURce:]VOLTage3 <n>	sets Output VOLTAGE ϕC. Range of n is <0> to <150, or 136.5 x XFMRRATIO> Volts. See note 19 for query method.

5.4.1 OUTPUT PARAMETERS (cont)

:[SOURce:]FREQuency <n> sets Output Frequency. Range of n is <20.00> to <5000> Hz. See note 19 for query method. For convenience, another query for programmed Frequency is available via the :MEASure:FREQuency? command. The returned value is an indicator only as the UPC does not actually measure Frequency.

:[SOURce:]CURRent:LIMit <n>
sets Output Current Limit. Range of n is <0> to <Current meter range> RMS Amps. See note 19 for query method.

:[SOURce:]PHASe2 <n> sets Output ϕ angle. Range of n is <0> to <359> degrees. See note 19 for query method.

:[SOURce:]PHASe3 <n> sets Output ϕ angle C. Range of n is <0> to <359> degrees. See note 19 for query method.

:[SOURce:]WAVEFORM <n> sets Output Waveform. Range of n is <1> to <16>. See note 19 for query method.

:[SOURce:]WAVEFORM1 <n>
sets Output Waveform ϕA. Range of n is <1> to <16>. See note 19 for query method.

:[SOURce:]WAVEFORM2 <n>
sets Output Waveform ϕB. Range of n is <1> to <16>. See note 19 for query method.

:[SOURce:]WAVEFORM3 <n>
sets Output Waveform ϕC. Range of n is <1> to <16>. See note 19 for query method.

:[SOURce:]RAMP <t> sets Output TRANSITION TIME of voltage and frequency execution. Range of t is <0> to <300> seconds in 200 uS steps.

5.4.1 OUTPUT PARAMETERS (cont)

:[SOURce:]FREQuency:LIMit:MAXimum <n>
sets Output Frequency max limit. Range of n is <20.00> to <5000> Hz.

:[SOURce:]FREQuency:LIMit:MINimum <n>
sets Output Frequency min limit. Range of n is <20.00> to <5000> Hz.

:[SOURce:]VOLTage:LIMit:MAXimum <n>
sets Output Voltage max limit. Range of n is <0.0> to <600> VAC RMS.

:[SOURce:]VOLTage:LIMit:MINimum <n>
sets Output Frequency min limit. Range of n is <0.0> to <600> VAC RMS.

:[SOURce:]RANGe <n> sets Output Range Control (for power sources that support Range Control). Range of n is <0> to <4>. A value of 0 sets the Range Control mode to AUTO. See section on GENERAL SETUP for more info.

5.4.1 OUTPUT PARAMETERS (cont)

:[SOURce:]IMPEDance:STATE <b>

Enables or disables the optional Programmable Output Impedance function. Values for b are <OFF> or <ON> or <0>OFF or <1>ON.

:[SOURce:]IMPEDance <z> Sets the optional Programmable Output Impedance. Values for z vary based on the present configuration and operational mode of the power source.

:[SOURce:]IMPEDance:CAL <z1,z2,z3, x1,z4, x2,z5, x3,z6>

Calibrates the optional Programmable Output Impedance function with values for:

Direct Coupled 1ϕ	z1 Ω	
Direct Coupled 2ϕ	z2 Ω	
Direct Coupled 3ϕ	z3 Ω	
XFMR Coupled - Ratio X x1:1		z4 Ω
XFMR Coupled - Ratio Y x2:1		z5 Ω
XFMR Coupled - Ratio Z x3:1		z6 Ω

See section 4 for details on this function.

:[SOURce:]IMPEDance:RESet Resets Programmable Output Impedance calibration values to the factory defaults.

5.4.2 SIGNAL ROUTING

:[SOURce:]FORM <n> Sets Output power form. Values for n are <1>Single ϕ, <2>Split ϕ, or <3>Three ϕ. See note 19 for query method.

:[SOURce:]COUPLING <s> Sets Output coupling. Values for s are <DIRECT> or <XFMR>. See note 19 for query method.

:[SOURce:]VOLTage:ALC[:STATE] <b>
The ALC keyword controls CSC. Values for b are <OFF> or <ON> or <0>OFF or<1>ON.

:SENSe:PATH <s> selects source for metering and CSC. Values for n are <0>Internal or <1>External.

:OUTPut[:STATE] <b> OUTPUT ENABLE command. Values for b are <OFF>, <ON>, <0>OFF or <1>ON. Placing the OUTPUT POWER ON-AUTO/OFF switch in the OFF position overrides the OUTPUT ENABLE command. Query returns actual state of output contactors, <0>OFF or <1>ON, not the OUTPUT ENABLE value.

5.4.3 WAVEFORM CONTROL

:PROGRAM:NAME <Wfnn> selects waveform n for loading or data query. No query for nn. Range of nn is 1 to 99 for data query or 1 to 16 for data defining (loading).

:PROGram:[SELected:]DEFine <data>
loads selected waveform (1-16) with data from the IEEE-488 Bus. The number of data elements must be 1024, representing 0-359.5 degrees in .351° steps. Each element is a signed percentage of peak full scale voltage. Each element must be separated by a comma. NOTE: Only commas may separate the values, NO Carriage Returns or Line Feeds may separate the values.
Eg; <0,+5,+10,-50,+20,+25,+30> % .

5.5 QUERY FUNCTIONS

The following is a list of 'query only' functions sent by the UPC through the IEEE-488 Bus.

5.5.1 CONFIGURATION QUERIES

These query parameters cannot be set via IEEE-488 Bus communications as they are set via DIP switches within the UPC.

:[SOURce]:XFMRRATIO? Output XFMR ratio query. Returns <0.1> to <2.5> to one.

:SENSe:CURRent:RANGe? AMPS meter range query. Returns <0> to <AMPS meter range> RMS Amps.

5.5.2 METERED DATA QUERIES

Measurement of all parameters is performed once per :MEASure command received from the Bus controller.

AC measurements are assumed. The **:AC** keyword following **:MEASure** is optional and is not shown here.

The question mark is optional as the **:MEASure:** command implies a query. Any values following the command are ignored.

'Multiple keyword' queries may be performed to obtain values of simultaneous measurements. Eg; **:MEASure:VOLTage1;VOLTage2;VOLTage3?**

:MEASure:VOLTage1? metered voltage ϕA query. Returns <0> to <354> VAC RMS.

:MEASure:VOLTage2? metered voltage ϕB query. Returns <0> to <354> VAC RMS.

:MEASure:VOLTage3? metered voltage ϕC query. Returns <0> to <354> VAC RMS.

:MEASure:VLL1? metered Line to Line voltage ϕA to ϕB query. Returns <0> to <354> VAC RMS.

:MEASure:VLL2? metered Line to Line voltage ϕB to ϕC query. Returns <0> to <354> VAC RMS.

:MEASure:VLL3? metered Line to Line voltage ϕC to ϕA query. Returns <0> to <354> VAC RMS.

5.5.2 METERED DATA QUERIES (cont)

:MEASure:FREQuency?	This is a query for programmed Frequency. The returned value is only an indicator of the programmed Frequency as the UPC does not actually measure Frequency. Returns <20.00> to <5000> Hz.
:MEASure:CURRent[:RMS]1?	metered RMS current ϕA query. Returns <0> to <current meter range> AAC RMS.
:MEASure:CURRent[:RMS]2?	metered RMS current ϕB query. Returns <0> to <current meter range> AAC RMS.
:MEASure:CURRent[:RMS]3?	metered RMS current ϕC query. Returns <0> to <current meter range> AAC RMS.
:MEASure:CURRent:PEAK1?	metered peak current ϕA query. Returns <0> to <current meter range> AAC Peak.
:MEASure:CURRent:PEAK2?	metered peak current ϕB query. Returns <0> to <current meter range> AAC Peak.
:MEASure:CURRent:PEAK3?	metered peak current ϕC query. Returns <0> to <current meter range> AAC Peak.
:MEASure:CURRent:CREST1?	metered current Crest factor ϕA query. Returns <0> to <1000>.
:MEASure:CURRent:CREST2?	metered current Crest factor ϕB query. Returns <0> to <1000>.
:MEASure:CURRent:CREST3?	metered current Crest factor ϕC query. Returns <0> to <1000>.

5.5.2 METERED DATA QUERIES (cont)

:MEASure:POWer1?	metered Kilowatts ϕA query. Returns <0> to <1000> KW.
:MEASure:POWer2?	metered Kilowatts ϕB query. Returns <0> to <1000> KW.
:MEASure:POWer3?	metered Kilowatts ϕC query. Returns <0> to <1000> KW.
:MEASure:KVA1?	metered KiloVoltAmps ϕA query. Returns <0> to <1000> KVA.
:MEASure:KVA2?	metered KiloVoltAmps ϕB query. Returns <0> to <1000> KVA.
:MEASure:KVA3?	metered KiloVoltAmps ϕC query. Returns <0> to <1000> KVA.
:MEASure:PF1?	metered power factor (KW/KVA) ϕA query. Returns <0> to <1.0>.
:MEASure:PF2?	metered power factor (KW/KVA) ϕB query. Returns <0> to <1.0>.
:MEASure:PF3?	metered power factor (KW/KVA) ϕB query. Returns <0> to <1.0>.

:FETCh[:WAVEform]:VOLT1?
:FETCh[:WAVEform]:CURRent1?

returns a string representing the metered data waveform. **:VOLT1** may be replaced with **:VOLT2** or **:VOLT3** for phase B and C volts respectively, or **:CURR1**, **:CURR2** or **:CURR3** for phase A, B and C current respectively. Each waveform consists of 512, NR2 type numbers separated by commas. Each waveform is terminated by a semi-colon.

5.5.2 METERED DATA QUERIES (cont)

:MEASure:SPECTrum:VOLT1[:MAGnitude]

(optional) returns a data set representing the first 256 harmonic magnitudes as a percentage of the PHASE A VOLTAGE fundamental. **:VOLT1** may be replaced with **:VOLT2** or **:VOLT3** for phase B and C volts respectively, or **:CURR1**, **:CURR2** or **:CURR3** for phase A, B and C current respectively.

This data set consists of 256, NR2 type numbers separated by commas. The first element is the magnitude of the fundamental for reference. The second element is the 2nd harmonic, the third element is the 3rd harmonic, and so on.

:MEASure:SPECTrum:PHASe

(optional) returns a data set representing the first 256 harmonic phase angles in degrees for the last **:MEASure:SPECTrum:parameter** command. If parameter was PHASE A VOLTS then the phase angles will be for PHASE A VOLTS.

This data set consists of 256, NR2 type numbers separated by commas. The first element is the angle of the fundamental for reference. The second element is the angle of the 2nd harmonic, the third element is the angle of the 3rd harmonic, and so on.

5.5.2 METERED DATA QUERIES (cont)

:MEASure:SPECTrum:THD?	(optional) returns TOTAL HARMONIC DISTORTION of the last :MEASure:SPECTrum:parameter command. If parameter was PHASE A VOLTS then the THD value will be for PHASE A VOLTS.
:MEASure:SPECTrum:OHD?	(optional) returns ODD HARMONIC DISTORTION of the last :MEASure:SPECTrum:parameter command. If parameter was PHASE A VOLTS then the OHD value will be for PHASE A VOLTS.
:MEASure:SPECTrum:EHD?	(optional) returns EVEN HARMONIC DISTORTION of the last :MEASure:SPECTrum:parameter command. If parameter was PHASE A VOLTS then the EHD value will be for PHASE A VOLTS.

5.5.3 EVENT and STATUS REPORTING

Events and device Status may be queried by the Bus controller through the following registers and queues. Query commands are explicitly shown in this section for clarity. NOTE: It is recommended that reading EVENT and STATUS registers and queues occur in the following order. Reading any register or queue is optional. Indents indicate a hierarchy.

1. STB register, read via Serial Poll or ***STB?**.

    2. ESR register, read via ***ESR?**.

        3. **SYSTem:ERRor?** queue.

    4. **STATus:OPERation:EVENt?** register.

    5. **STATus:QUEStionable:EVENt?** register.

NOTE: For most applications, the STB register and SYSTem:ERRor queue will satisfy status and error reporting.

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5.5.3.1 IEEE-488.2 STATUS REPORTING

The following lists the IEEE-488.2 Common Commands for Status Reporting from the UPC. Refer to the ANSI/IEEE-488.2 1987 standard for more information.

Query commands are explicitly shown in this section for clarity. NOTE: <NRf> indicates a Numeric Response format. See section 5.2 Conventions regarding <NRf>.

STATUS BYTE REGISTER (STB)

STATUS conditions reported by the STATUS BYTE may be queried via the IEEE-488 Bus Serial Poll function, or read directly using *STB?. The SRQ function will be invoked to signal the Bus controller that service is requested, when an unmasked STATUS BYTE bit goes true. Note that no SRQ is generated while in LOCAL CONTROL. *CLS clears the ESR and the STB. Refer to figure 5.1.

BIT	NAME	DEFINITION
7	SOS	:STATus:OPERation register bit summary.
6	MSS/RQS	-MASTER SUMMARY summarizes all STATUS BYTE bits (except bit 6) for *STB?, or, -REQUEST SERVICE indicates this device requested service when a Serial Poll was performed.
5	ESB	STANDARD EVENT STATUS REGISTER bit summary.
4	MAV	MESSAGE AVAILABLE indicates Query response data is available.
3	SQS	:STATus:QUEStionable register bit summary.
2	EEQ	ERROR/EVENT QUEUE indicates an SCPI Error/Event message is available.
1	-----	NOT DEFINED
0	SHUTDOWN	indicates Power Source SHUTDOWN.

Setting a SERVICE REQUEST ENABLE (SRE) bit true unmasks the STATUS bit in the STB. Bit 6 of the SRE is not applicable as the MASTER SUMMARY bit of the STB cannot be masked. The STB, SRE, ESR and ESE registers are 8 bits each.

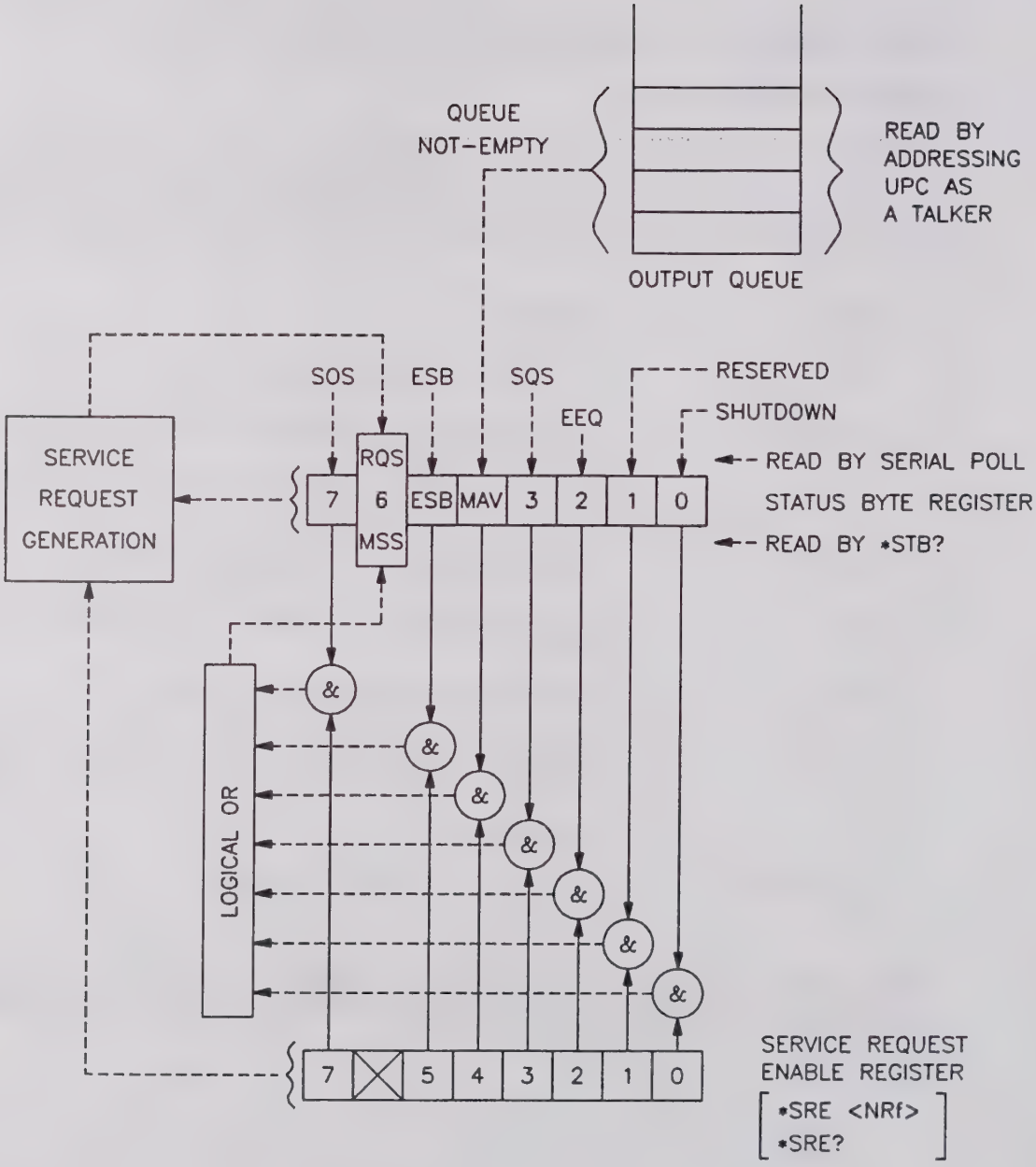

FIGURE 5.1 STATUS BYTE MODEL

5.5.3.1 IEEE-488.2 STATUS REPORTING (cont)

STANDARD EVENT STATUS REGISTER (ESR)

Events reported by the STANDARD EVENT STATUS register may be queried via the ***ESR?** command. Reading the ESR register clears it. The EVENT STATUS summary bit in the STATUS BYTE (STB) will be set when an unmasked EVENT STATUS bit goes true. Refer to figure 5.2.

BIT	NAME	DEFINITION
7	PON	POWER ON indicates Input power was just applied.
6	URQ	USER REQUEST indicates "LOCAL" key was just pressed.
5	CME	COMMAND ERROR indicates invalid command or query received.
4	EXE	EXECUTION ERROR indicates can't execute command with data received.
3	DDE	DEVICE DEPENDANT ERROR indicates UPC not properly configured.
2	QYE	QUERY ERROR indicates cannot respond with data.
1	RQC	REQUEST CONTROL - not used.
0	OPC	OPERATION COMPLETE indicates previous operation complete.

Setting an EVENT STATUS ENABLE (ESE) bit true unmasks the EVENT bit in the ESR. Also see **:SYSTem:ERRor?** query for corresponding information.

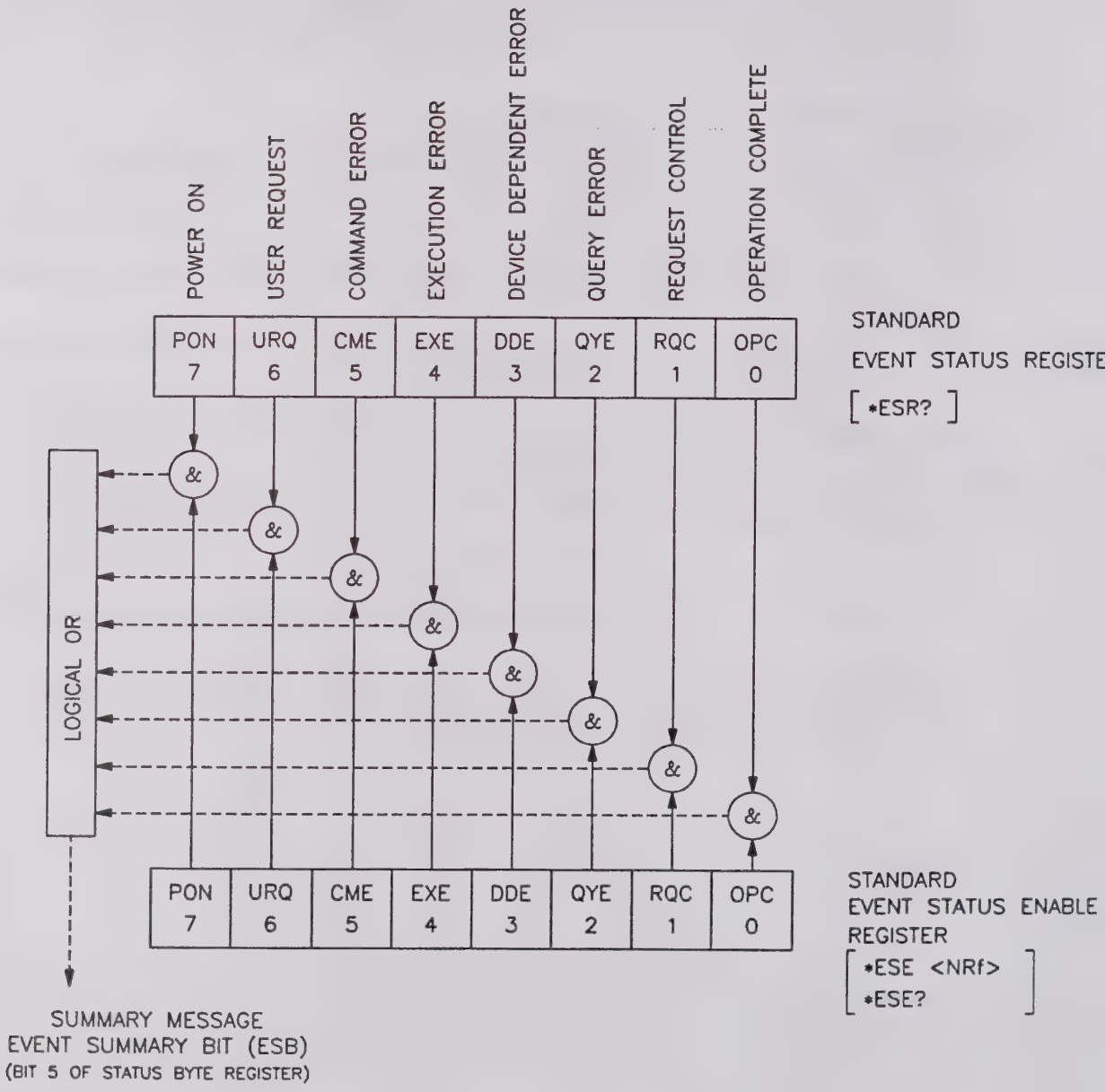

FIGURE 5.2 STANDARD EVENT REGISTER MODEL

5.5.3.1 IEEE-488.2 STATUS REPORTING (cont)

IEEE-488.2 STATUS REPORTING COMMANDS

***IDN?**	Device Identification query. Returns <PPSC UPC vN.N> where N.N is the firmware version number.
***CLS**	Clears the ESR and the STB registers as well as the SCPI :EVENt registers and ERROR/EVENT queue.
***STB?**	Read status byte query. Bit 0 is Power Source SHUTDOWN.
***SRE <n>**	Service request enable command.
***SRE?**	Service request enable query.
***ESE <n>**	Standard event status enable.
***ESE?**	Standard event status enable query.
***ESR?**	Standard event status register query.
***OPC**	Operation complete command.
***OPC?**	Operation complete query.

5.5.3.2 SCPI STATUS REPORTING

The following lists the SCPI Commands for **Status Reporting** from the UPC. Refer to the SCPI 1992 standard for more information. See section 5.2 Conventions regarding SCPI.

Query commands are explicitly shown in this section for clarity. Refer to figure 5.3.

:SYSTem:ERRor? system error query. Returns one of the following types of messages, with details appended to it if possible. A maximum of 256 characters may be sent as a response to this query.

-0, "No error"	No error detected.
-100, "Command error"	indicates invalid command or query received.
-200, "Execution error"	indicates can't execute command with parameters received.
-300, "Device-specific error"	indicates UPC not properly configured.
-400, "Query error"	indicates query aborted.

NOTE: The SYSTem:ERRor query clears the corresponding error bit in the ESR.

5.5.3.2 SCPI STATUS REPORTING (cont)

:SYSTem:VERSion? SCPI version query. Returns <1992.0>.

The STATus:OPERation and STATus:QUEStionable registers provides information about the current mode of operation. Transition of a CONDition bit to the true state causes the EVENt bit to be set true. An unmasked ENABle bits allow an EVENt bit to be reported in the summary bit for that EVENt register in the STATUS BYTE register. Setting an ENABLe bit true unmasks the corresponding EVENt bit. Reading an EVENt register clears it. All :STATUS registers are 15 bits. Refer to figure 5.3.

The STATus:OPERation registers provides information about the current mode of operation. NOTE: Most bits in the following :STATus registers are not applicable to the UPC but are shown for reference and may be used for future product enhancements. The PROGram running bit (14) in the :STATus:OPERation registers indicate a stored program (PROGRAM# 1-99) is running.

:STATus:OPERation:CONDition? current condition query.

:STATus:OPERation:ENABle enables events to be reported in the SOS bit in the STB.

:STATus:OPERation:ENABle? STAT:OPER:ENABLE register query.

:STATus:OPERation:EVENt? latched condition query.

The STATUS:QUESTIONABLE registers provides information about errors and questionable measurements. NOTE: All bits in the following :STATus registers are not applicable to the UPC but are shown for reference and may be used for future product enhancements.

:STATus:QUEStionable:CONDition? current condition query.

:STATus:QUEStionable:ENABle enables events to be reported in the SQS bit in the STB.

:STATus:QUEStionable:ENABle? STAT:OPER:ENABLE register query.

:STATus:QUEStionable:EVENt? latched condition query.

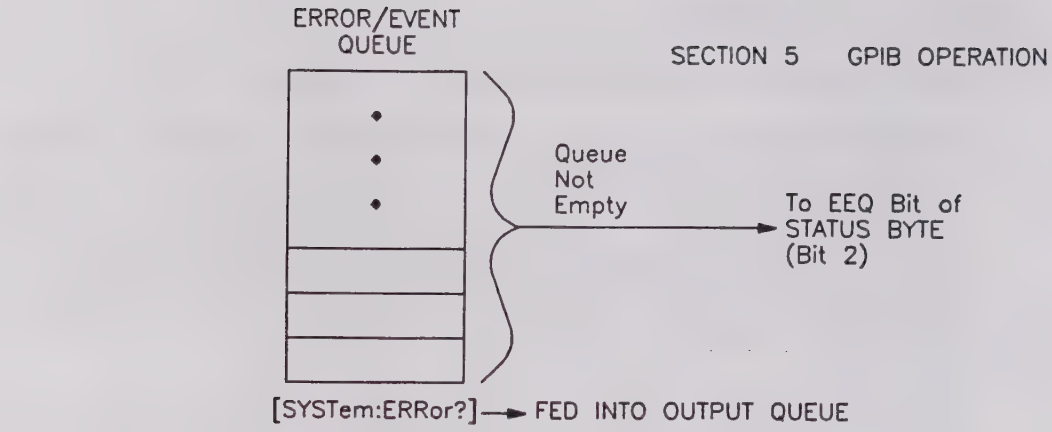

FIGURE 5.3 SCPI STATUS REGISTERS MODEL

5.6 DEVICE CONTROL

:SYSTem:BEEPer beeps the front panel beeper once.

:CALibrate:ZERO Resets all Metering correction factors. The UPC meters are then essentially uncalibrated although still functional.
See the Externally Referenced CALIBRATION procedure (section 8.3) for details.

:CALibrate:DATA <k_int_Va, k_int_Vb, k_int_Vc,
k_ext_Va, k_ext_Vb, k_ext_Vc,
k_Ia, k_Ib, k_Ic >

Loads values measured with an external DVM and Ammeter. These values are used by the UPC to calibrate the metering functions of the UPC.

The first 3 values are Voltages measured at the output terminals of the power source.

The second set of 3 values are Voltages measured at the EXTernal Sense point (at the load).

The third set of 3 values are Currents measured to the load.

Loading a value of 0 will cause that metering parameter to be uncalibrated although it will still be functional.

See the Externally Referenced CALIBRATION procedure (section 8.3) for more details.

5.6.1 IEEE-488.1 INTERFACE FUNCTIONS

The following lists the IEEE-488.1 capabilities of the UPC. Refer to the ANSI/IEEE-488.1 1987 standard for more information.

FUNCTION MNEMONIC	REMOTE MESSAGE RECEIVED / Description
SH1	Source handshake functions.
AH1	Acceptor handshake functions.
T6	**MTAnn** - Talker subset 6. nn is GPIB device address 0-30.
L3	**MLAnn** - Listener subset 3. nn is GPIB device address 0-30.
SR1	Service request/Serial Poll functions. **SPE** - Serial Poll Enable **SPD** - Serial Poll Disable
RL1	Local/Remote functions. **GTL** - Go To Local **LLO** - Local Lockout
DC1	Device clear functions. **DCL** - causes a hardware reset of the UPC. **SDC** - Same as DCL but device must be addressed.
DT1	Device Trigger function. **GET** - Group Execute Trigger message executes Transient Events (if any), of currently executed program.
PP0	No Parallel Poll functions.
C0	No Controller functions.
E1	Electrical interface Type 1.
IFC	InterFace Clear (**IFC**) sets the UPC IEEE-488 bus interface to an idle state. The input and output buffers remain unchanged.

5.6.2 IEEE-488.2 DEVICE CONTROL COMMANDS

The following lists the IEEE-488.2 Common Commands for **Device Control** of the UPC. Refer to the ANSI/IEEE-488.2 1987 standard for more information.

***RST** Reset command. Initialize the UPC with the following parameters:

CSC OFF
INTERNAL SENSE
PROG. Zo. OFF
TRANSITION TIME = 0
MAX FREQUENCY = 5000 Hz.
MIN FREQUENCY = 20 Hz.
OUTPUT DISABLED.
MANUAL MODE

OUTPUT FORM = 1 or 3 (depending on model)
OUTPUT COUPLING = DIRECT
OUTPUT FREQUENCY = 60 Hz.
OUTPUT VOLTAGES = 120 VAC RMS
CURRENT:LIMIT = CURRENT METERING RANGE
PHASE ANGLE B = 120°
PHASE ANGLE C = 240°
WAVEFORM ϕA = 1
WAVEFORM ϕB = 1
WAVEFORM ϕC = 1

Stored programs are not erased.

***TST?** Self test query. Test validity of non-volatile RAM.

***WAI** Wait-to-continue command. Only useful following the :PROG:EXEC:TRANS or *TRG commands as all other commands are executed sequentially as the Program Message is parsed.

***TRG** IEEE-488.2 Device trigger function. Executes Transient Events (if any), of currently executed program.

5.7 REMOTE CONTROL EXAMPLES

The REN (remote enable) line on the bus interface must be kept true to maintain REMOTE CONTROL. REMOTE CONTROL can only be initiated while the UPC is displaying a Metering display (not while editing) or while in the UPC STATUS display. Be sure that the UPC GPIB device address is set to a known unique address within the GPIB system. The factory default device address is 1. See section 4.5.3.3 for configuration of the GPIB device address. See section 10 for setting up the RS-232 SERIAL INTERFACE parameters if this option is used.

Optional keywords have been omitted throughout this section for clarity. The command strings may contain spaces.

NOTE: Un-address means to send the UNTALK and UNLISTEN messages. This is only applicable for the GPIB, NOT the RS-232 option. With many programming languages that support GPIB communications, listener and talker addressing and un-addressing is handled automatically and is transparent to the user. Check your programming language or driver documentation for verification of this.

NOTE: <eos> should be a LINE FEED (0Ahex, 10dec). See GPIB convention #16 (Section 5.2) for more details.

5.7.1 EXAMPLE OF STORING A PROGRAM

NOTE: <eos> is a LINE FEED (0Ahex, 10dec).

Step A. Address the UPC as a listener.

:PROGram:NAME 1 <eos> Step B. Select Program 1 for loading.

Step C. Define program 1. Program 1 consists of steady-state and optional transient segment parameter names and values. This is one continuous string of commands and parameters. NOTE: Only commas may separate the values, NO Carriage Returns or Line Feeds may separate the values.

:PROGram:DEFine

FORM,3,
COUPLing,DIRECT,
XFMRRATIO,1.0,
FREQuency,60,
VOLTage1,115,
VOLTage2,115,
VOLTage3,115,
CURRent:LIMit,10
PHASe2,120,
PHASe3,240,
WAVEFORM1,1,
WAVEFORM2,1,
WAVEFORM3,1,
EVENTS,0,

OPTIONAL TRANSIENT PARAMETERS

SEGment,1,
FSEG,60,
VSEG1,120,
VSEG2,120,
VSEG3,120,
WFSEG1,1,
WFSEG2,1,
WFSEG3,1,
TSEG,.01,
LAST<eos>

Step D. Un-address UPC.

5.7.2 EXAMPLE OF PROGRAM QUERY

NOTE: <eos> is a LINE FEED (0Ahex, 10dec).

Step A. Address the UPC as a listener.

:PROGram:NAME 1 <eos> Step B. Select Program 1 for query by sending the following command.

:PROGram:DEFine? <eos> Step C. Query program 1 by sending the following command. Program 1 consists of steady-state and optional transient segment parameter names and values.

This Query returns steady-state values of selected program and segment values of the most recently selected segment (see note 1). "LAST" is returned with segment data if the segment is the last segment in the program.

Step D. Address the UPC as a talker to read back the following example query response string. NOTE: Only commas separate the values, NO Carriage Returns or Line Feeds separate the values.

STEADY-STATE OUTPUT PARAMETERS returned

FORM,3,
COUPLing,DIRECT,
XFMRRATIO,1.0,
FREQuency,60,
VOLTage1,115,
VOLTage2,115,
VOLTage3,115,
CURRent:LIMit,10
PHASe2,120,
PHASe3,240,
WAVEFORM1,1,
WAVEFORM2,1,
WAVEFORM3,1,
EVENTS,0,

NOTE 1: To select a segment for query, send :PROGram:DEFine SEG,n <eos>, where n is the segment of interest. Then send the query, :PROGram:DEFine? <eos> then address the UPC as a talker. The steady-state values of the selected program and segment values of the most recently selected segment will be sent by the UPC.

5.7.2 EXAMPLE OF PROGRAM QUERY (cont)

OPTIONAL TRANSIENT PARAMETERS returned

SEGment,1,
FSEG,60,
VSEG1,120,
VSEG2,120,
VSEG3,120,
WFSEG1,1,
WFSEG2,1,
WFSEG3,1,
TSEG,.01,
LAST<eos>

Step E. Un-address UPC.

5.7.3 EXAMPLE OF EXECUTING A STORED PROGRAM

NOTE: <eos> is a LINE FEED (0Ahex, 10dec).

Step A. Address the UPC as a listener.

:PROGram:NAME 1 <eos> Step B. Select Program 1 for executing.

:PROGram:EXECute <eos> Step C. Execute Program.

Step D. Un-address UPC.

5.7.4 EXAMPLE OF EXECUTING A STORED PROGRAM TRANSIENT

NOTE: <eos> is a LINE FEED (0Ahex, 10dec).

Step A. Address the UPC as a listener.

:PROGram:NAME 1 <eos> Step B. Select Program 1 for executing.

:PROGram:EXECute <eos> Step C. Execute Program.

:PROGram:EXECute:TRANS <eos> Step D. Execute Transient.

Step E. Un-address UPC.

5.7.5 EXAMPLE OF DIRECTLY CHANGING THE OUTPUT PARAMETERS

This example changes Frequency and Volts for all phases then ENABLES the OUTPUT.

	Step A. Address the UPC as a listener.
:FREQuency 50 <eos>	Step B. Change Frequency to 50 Hz.
:VOLTage 117 <eos>	Step C. Change Volts to 117 VAC RMS for all phases.
:OUTput ON <eos>	Step D. ENABLES the OUTPUT. The OUTPUT POWER switch must be in the ON/AUTO position to allow power to be applied to the load.
	Step E. Un-address UPC.

An alternative to steps B, C and D above is:

:FREQ 50; :VOLT 117; :OUT ON<eos>	This example uses all shortform keywords in one program message. The OUTPUT POWER switch must be in the ON/AUTO position to allow power to be applied to the load.
- or -	
:OUTput OFF <eos>	Turns the output OFF.

- - - C A U T I O N - - -

All :SOURce parameters should be set prior to enabling the OUTPUT for the first time after power-on or after resetting the device. An alternative to this is to :DEFine and :EXECute a stored program. See section 5.7.1 and 5.7.3.

- - - C A U T I O N - - -

5.7.6 EXAMPLE OF VOLTAGE and CURRENT MEASUREMENT QUERY

This is an example of how to query the UPC for metered values. LINE to LINE volts, KVA, KW Power Factor, CURRENT Crest factor, and Peak Current may also be queried in the following fashion. See the :**FETCH** command and example for obtaining metered waveform data.

Three phase RMS volts (Line to Neutral) and RMS current is queried in this example.

NOTE: <eos> is a LINE FEED (0Ahex, 10dec).

Step A. Address the UPC as a listener.

Step B. Select Voltages A,B,C and Load Current A,B,C for AC-RMS query by sending the following command.

:MEAS:VOLT1;VOLT2;VOLT3;CURR1;CURR2;CURR3? <eos>

NOTE: All parameters will be measured simultaneously upon receipt of the :MEAS: command. This may take several hundred milliseconds depending upon Frequency and other factors. The values are not stored in the UPC and another :MEAS: command will re-measure the values.

Step C. Address the UPC as a talker to read back the following example query response string. NOTE: Only commas separate the values, NO Carriage Returns or Line Feeds separate the values.

120.2,
120.3,
121.0,
3.2,
2.9,
3.0<eos>

Step D. Un-address UPC.

5.7.7 EXAMPLES OF VOLTAGE and CURRENT WAVEFORM QUERY

This is an example of how to query the UPC for metered waveform values for phase A voltage and current.

NOTE: <eos> is a LINE FEED (0Ahex, 10dec).

Step A. Address the UPC as a listener.

Step B. Select Voltage A and Load Current A for waveform query by sending the following command.

:FETCh? VOLTage1;CURRent1 <eos>

NOTE: This command should immediately follow a :MEASure command in one Program Message to obtain waveform data corresponding with the values retrieved by the :MEASure command (example shown below).

NOTE: All parameters will be measured simultaneously upon receipt of the :FETCH? command. This may take several hundred milliseconds depending upon Frequency and other factors. The values are not stored in the UPC and another :FETCH? command will re-measure the values.

Step C. Address the UPC as a talker. The UPC returns a string representing the last metered data waveform. Each waveform consists of 180, NR2 type numbers separated by commas. Each waveform is terminated by a semi-colon.

Step D. Un-address UPC.

An example command (substitute for step B above) for obtaining simultaneous RMS voltage and current values and waveforms for PHASE A is as follows.

:MEASure:VOLTage1?;CURRent1?;:FETCh? VOLTage1;CURRent1 <eos>

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SECTION 6

MAINTENANCE

6 MAINTENANCE

No maintenance is required.

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SECTION 7

SERVICE

7 SERVICE

Pacific Power Source maintains a staff of highly trained technicians which are able to assist with diagnosing abnormal operation of the UPC. If questions arise, feel free to call the factory at 1-714-898-2691 (8am to 5pm PST (California)).

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SECTION 8

CALIBRATION

8 CALIBRATION

This section describes two methods of calibration of a UPC. The first method (para 8.2.X) is a fully manual procedure requiring that the top cover of the UPC (or power source) be removed. Manual calibration achieves calibration of the oscillator output gains (Output voltage), the Programmable Current Limit circuit, and basic metering calibration. If output voltage accuracy is desired, this procedure is necessary if EXTERNALLY REFERENCED CALIBRATION is not performed (below) and CSC is not used.

The second method (para 8.3) is the EXTERNALLY REFERENCED CALIBRATION. It requires NO manual adjustment or access of internal circuits (except for optionally calibrating the Current Limit circuit). Externally referenced CALIBRATION achieves high calibration accuracy of the metering circuits. This procedure must be performed in order for the CSC (Continuous Self Calibration) function to operate accurately. The Manual calibration procedure is not necessary for CSC to operate accurately if EXTERNALLY REFERENCED CALIBRATION is performed.

It is necessary to perform the MANUAL CALIBRATION and then the EXTERNALLY REFERENCED CALIBRATION to fully calibrate the SYSTEM for output voltage, current limit and metering accuracy.

8.1 CALIBRATION INTERVAL

The UPC requires calibration once every six months or after service has been performed to the system.

8.1.1 TEST EQUIPMENT REQUIREMENTS

The test equipment listed below is required for MANUAL calibration of the UPC installed in a Power Source.

1. Digital Voltmeter: 4½ Digit True-RMS responding 5000 Hz bandwidth, min.
2. Frequency counter: 5 digit counter, min.
3. Oscilloscope: (Optional)
4. *High current load (capable of 60% Peak rated output current of power source)
5. *Ammeter probe (Shunt type preferred) or ammeter capable of reading RMS amps.

* = (only needed for calibrating Programmable current limit)

8.2 MANUAL CALIBRATION PROCEDURE

The calibration procedure which follows verifies that system gains are set properly. Paragraphs 8.2.1 and 8.2.2 detail the procedure used to check and adjust the various parameters. The procedure is written for three phase systems. When calibrating single phase systems, ignore all instructions relating to phases B and C.

*** * * WARNING * * ***

- OBSERVE THE FOLLOWING WHEN CALIBRATION IS REQUIRED:

1)REMOVE ALL JEWELRY FROM ARMS AND NECK WHEN CALIBRATING THIS EQUIPMENT. THIS PREVENTS THE POSSIBILITY OF SHORTING THROUGH THE JEWELRY AND CAUSING BURNS TO OR ELECTROCUTION OF THE OPERATOR.

2)**WEAR SAFETY GLASSES** WHEN CALIBRATING THIS EQUIPMENT TO PREVENT EYE INJURY DUE TO FLYING PARTICLES CAUSED BY ACCIDENTAL SHORT CIRCUIT CONDITIONS.

3)DO NOT REMOVE ANY PANELS OR COVERS WITHOUT FIRST OPENING **ALL** CIRCUIT BREAKERS AND THEN REMOVING THE INPUT SERVICE.

*** * * WARNING * * ***

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8.2.1 OSCILLATOR GAIN CALIBRATION

The first step in the MANUAL calibration process is to calibrate the oscillator gains. Nominally, the oscillator produces 5.000 VAC_{rms} when the system is programmed for 125.0 VAC_{rms} (system configured for DIRECT COUPLED output). This step in the procedure sets this level. The calibration proceeds as follows: (Refer to Figure 8.2 for location of controls)

1. Remove top cover of the chassis.

2. Turn on the system and load a program into the UPC with the following parameters:

```
PROGRAM: #1  FORM=3 COUPLING=DIRECT
FREQ=60      Va=125.0  Vb=125.0  Vc=125.0
             WFa=1     WFb=1     WFc=1
#SEGS=0    Ilim=50     PHb=120°  PHc=240°
```

3. Execute the program after it is loaded.

4. Calibrate the Phase A Oscillator Output by measuring the voltage at the Power Source Phase A output to Neutral with the 4½ digit DVM. Then adjust R70 on the Phase A Oscillator until the voltage is 125.00 VAC ±0.05 VAC_{rms}.

5. Calibrate the Phase B Oscillator Output by measuring the voltage at the Power Source Phase B output to Neutral with the 4½ digit DVM. Then adjust R70 on the Phase B Oscillator until the voltage is 125.00 VAC ±0.05 VAC_{rms}.

6. Calibrate the Phase C Oscillator Output by measuring the voltage at the Power Source Phase C output to Neutral with the 4½ digit DVM. Then adjust R70 on the Phase C Oscillator until the voltage is 125.00 VAC ±0.05 VAC_{rms}.

7. Verify the output frequency is 60.00 hertz +/- .01%. There is no adjustment for frequency.

8. Turn off the system.

9. Replace top cover of the chassis.

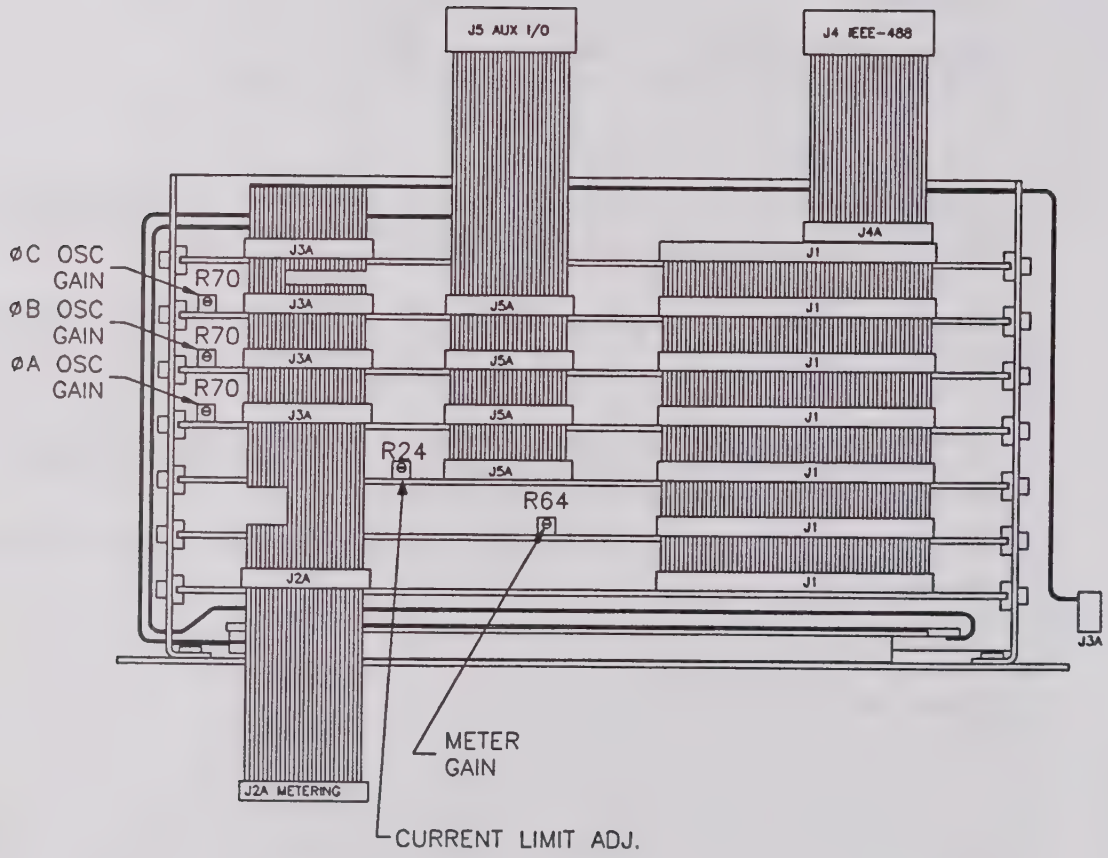

FIGURE 8.2 GAIN CONTROL LOCATIONS

8.2.2 PROGRAMMABLE CURRENT LIMIT CALIBRATION

1. Connect the high current load to the output of the power source.

2. Connect an Ammeter to the load wiring (Shunt type preferred).

3. Program the UPC Voltage to drive a load at 60% of rated output current of the power source @ 60 Hz.

4. Set the Programmable Current limit parameter of the UPC steady-state program to 50% of rated output current of the power source.

5. Apply output power to the load. Adjust R24 of the DRM PCB until the RMS current measured with the ammeter probe equals that of the programmed current limit value (in RMS amps). Refer to Figure 8.2 for location of control.

8.2.3 OUTPUT VOLTMETER CALIBRATION

The second step in the MANUAL calibration process is to calibrate the Output Voltmeter. Only one meter circuit is used for all voltage, current and power measurements. If other metering functions are out of specification after calibrating the Phase A voltmeter, return the unit for repair. The Output Voltmeter is calibrated as follows: (Refer to Figure 8.2 for control locations)

1. Remove top cover of the chassis.

2. Turn on the system and load a program into the UPC with the following parameters:

```
PROGRAM: #1  FORM=3 COUPLING=DIRECT
FREQ=60      Va=125.0  Vb=125.0  Vc=125.0
             WFa=1     WFb=1     WFc=1
#SEGS=0    Ilim=50     PHb=120°  PHc=240°
```

3. Execute the program after it is loaded.

```
V/I METER:                        ENTRY: 125.0
FREQ=60.00  Va=125.0  Vb=125.0  Vc=125.0
SENSE=INT  Vab=208.0 Vbc=208.0 Vca=208.0
MANUAL MODE Ia=00.0   Ib=00.0   Ic=00.0
```

4. Calibrate the Metering Circuit by measuring the Power Source output voltage, Phase A to Neutral, at the output terminal block with the 4½ digit DVM. Adjust R64 of the Metering PCB until the Va display on the front reads the same as the output voltage.

5. Turn off the system.

6. Replace top cover of the chassis.

8.3 EXTERNALLY REFERENCED CALIBRATION

This section describes the EXTERNALLY REFERENCED CALIBRATION procedure for calibrating the UPC which can be performed by the user.

The UPC is designed to be calibrated in the field. Calibration may be required in order to ensure that the EXECUTE voltage (the voltage actually produced by the power source) precisely agrees with COMMAND voltage (the desired voltage entered by the operator) when CSC is enabled. Potential sources of error which may cause difference between these two voltages are:

a) Drift in oscillator signal level.
b) Power Amplifier gain drift.
c) Output transformer turns ratio error. i.e. Actual turns ratio different from encoded turns ratio.
d) Difference between INT SENSE metering circuit and EXT SENSE metering circuit.
e) Internal metering inaccuracy.

Since the UPC display shows both PROGRAM (Command) and METERED voltages, these errors will reveal themselves - if they occur - as a slight difference between the two voltages. Only basic metering inaccuracy (e) will not reveal itself on the display.

CALIBRATE - EXT REF

In this procedure, the user

1. Sets up the UPC to generate output voltage and current.

2. Measures the voltages and currents on all phases using test equipment that has been calibrated to a traceable standard (ie; NBS, NIST).

3. Enters the measured values into the UPC keyboard (or Remote Interface).

The UPC then creates correction factors for it's metering functions and stores them in RAM. These correction factors (k factors) may be also be viewed by the user.

Normally, calibration is performed with default values of 60 Hz and 120 volts. Because of the precision and stability of the system, the correction factors are the same for all other values of volts and frequency. The user may calibrate the system at any frequency, voltage and current desired. Calibration of current metering is based on the Load Current set by the user. Therefore a nominal Load Current should be chosen for this calibration process.

NOTE: Only RMS voltages and currents are corrected.

CALIBRATION PROCEDURE
Externally Referenced CALIBRATION

*** * * WARNING * * ***

• OBSERVE THE FOLLOWING WHEN
CALIBRATION IS PERFORMED WITH THE OUTPUT CONTACTOR CLOSED:

1)REMOVE ALL JEWELRY FROM ARMS AND NECK WHEN CALIBRATING THIS EQUIPMENT. THIS PREVENTS THE POSSIBILITY OF SHORTING THROUGH THE JEWELRY AND CAUSING BURNS TO OR ELECTROCUTION OF THE OPERATOR.

2)**WEAR SAFETY GLASSES** WHEN CALIBRATING THIS EQUIPMENT TO PREVENT EYE INJURY DUE TO FLYING PARTICLES CAUSED BY ACCIDENTAL SHORT CIRCUIT CONDITIONS.

3)DO NOT REMOVE ANY PANELS OR COVERS WITHOUT FIRST OPENING ALL CIRCUIT BREAKERS AND THEN REMOVING THE INPUT SERVICE.

*** * * WARNING * * ***

1. Apply power to the power source and UPC.

2. Press **fn** to invoke the SETUP menu.

3. Select the 'CALIBRATION' menu.

```
CALIBRATION MENU: PRESS
1 RESERVED
2 FOR EXTERNALLY REFERENCED METER CALIB.
3 FOR Kfactor DISPLAY.
```

4. Enter the measurements taken with external test equipment (voltmeter, ammeter) for each parameter shown on the UPC display below. All measurements taken are to be AC RMS, Line to Neutral only for voltages.

In order to fully calibrate all current meters for all power forms, this procedure must be performed once for single phase and once for 3 phase operation (or 2 phase if 3 phase operation not available). Only the phases existent need to have values entered. If a phase parameter is not used or is not available as in the case of a 1 or 2 phase power source, the ϕC parameters should be set to 0. Entering 0 for a parameter causes the correction factor for that parameter to be set to 1.0000 .

Note that only I1 or Ia, Ib and Ic can be entered depending upon the power form currently in use.

ϕ	INT.V-SENSE	EXT.V-SENSE	I1 0.00
A	0.000	0.000	Ia 0.00
B	0.000	0.000	Ib 0.00
C	0.000	0.000	Ic 0.00

NOTE: Voltages are to be entered as AC RMS, Currents are to be entered as AC RMS.
LINE TO NEUTRAL only for voltages.

Each time a non-zero value is entered, the UPC measures the output signal for that parameter and compares it against the users entered calibration value. A new Correction factor is then calculated and used to correct that metered value.

Entering 0 for a parameter causes the correction factor for that parameter to be set to 1.0000. This may be done in order to clear any undesired metering compensation (correction) for that parameter.

If a value for a parameter is not keyed in, its correction factor will remain in memory and will not be re-calculated.

These correction factors (Kfactors) may be displayed with the CALIBRATION Menu (*fn*-4-3)

Upon completion, press **EXECUTE**.

The correction factors are stored in Battery-backed memory (RAM) until the memory is lost or cleared.

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SECTION 9

USER DIAGNOSTICS

9 USER DIAGNOSTICS

This section is intended to aid the user in solving common problems that may occur while using the UPC.

PROBLEM

Incorrect or illogical operation, or program values invalid, or "NO PROGRAM RUNNING", or "FPERR" is displayed.

PROBABLE CAUSE - Battery backed RAM information corrupt.

SUGGESTED CURE: Clear ALL RAM and RESET CPU. Refer to section 4.5.1.3 to perform this function.

To prevent the UPC from executing program parameters upon power-up, hold the **fn** key down while applying power with the INPUT POWER switch. You may then press **fn** again to enter the SETUP mode.

PROBLEM

LCD Display not readable

PROBABLE CAUSE - Battery backed RAM information corrupt.

SUGGESTED CURE: Clear ALL RAM and RESET CPU. Refer to section 4.5.1.3 to perform this function, or hold down the **CLEAR** key while applying INPUT POWER to the UPC. This will clear ALL RAM and RESET the CPU.

PROBLEM

ERROR Message states "ERROR - PROGRAMMED OUTPUT VOLTAGE VALUE EXCEEDS OUTPUT VOLTAGE RANGE. CHANGE VOLTAGE, COUPLING or WAVEFORM."

PROBABLE CAUSE - RMS content of selected Waveform is not great enough to produce programmed voltage.

If this type of error occurs when the UPC calculates segment step data for a transient program, the just prior to the one indicated as erronous, may contain a voltage which cannot be achieved by the segment indicated (because the current segment may be ramping from a voltage set in the previous segment).

SUGGESTED CURE: Change programmed Voltage, or change Coupling (to XFMR coupled with a higher voltage range (VR)), or
change the selected waveform (either by editing the Waveform or selecting a Waveform with a greater RMS content). See section 4.5.2.1 to edit a Waveform.

For this problem with transient segments, you may have to reduce the voltage in the segment prior to the one indicated as having the error as well as the one indicated as having the error.

PROBLEM

KEYS BEEP when pressed but display does not respond.

PROBABLE CAUSE - UPC is in REMOTE CONTROL (check the REMOTE LED on the keyboard).

SUGGESTED CURE: Change to LOCAL CONTROL by pressing the **LOCAL** key. If the REMOTE LED remains ON then the REMOTE INTERFACE controller has put the UPC into LOCAL LOCKOUT (LLO). Use the REMOTE INTERFACE controller to send the GOTO LOCAL (GTL) message or clear the REN (REMOTE ENABLE) signal from the GPIB controller. Turning the INPUT POWER to OFF will also restore LOCAL CONTROL.

PROBLEM

UPC does not respond to the GPIB.

PROBABLE CAUSE - GPIB device address incorrect or not unique..

SUGGESTED CURE: Verify device address selected within the GPIB controller software matches the GPIB device address within the UPC. There may only be a single device at each GPIB address. Refer to section 4.5.3.3 (UPC STATUS display) to verify or set the GPIB device address within the UPC.

You may also use the UPC STATUS display to verify receipt of an INTERFACE CLEAR (IFC) by the UPC from a GPIB controller. Refer to section 4.5.3.3 (UPC STATUS display) for usage of the IFC field.

The "LAST DATA BYTE" field indicates the data byte received by the UPC from the GPIB when the UPC was addressed as a listener. Normally if a properly terminated command string was received by the UPC, the LAST DATA BYTE received should be 0Ah (a Line Feed). The Line Feed character or END signal (EOI) is the proper end of string <eos> terminator. Refer to section 4.5.3.3 (UPC STATUS display) for usage of the LAST DATA BYTE field.

Characters sent one at a time to the UPC via the GPIB when the UPC is addressed to listen will be displayed in the LAST DATA BYTE field.

PROBLEM

UPC does not respond to the RS-232,
or responds with a COMMAND ERROR message.

PROBABLE CAUSES -

Incorrect communication parameters, ie; Serial baud rate, parity or number of data/start/stop bits.

Handshaking signals may not be wired correctly.

SUGGESTED CURE: Verify parameter settings match that of host computer. See section 10.3, 10.4.

Verify handshake signals are connected properly. See section 10.5.1 for additional help.

PROBLEM

UPC displays "TRANSITION IN PROGRESS"
for an extended length of time upon power-up.

PROBABLE CAUSES - A long Transition time was programmed into the UPC. The UPC is designed to execute the previously executed Program parameters or Manual mode parameters upon power-up.

SUGGESTED CURE: If it is desired to terminate the Transition, press the **TRANS** key. To prevent the UPC from beginning the Transition, hold the **fn** key down while applying power with the INPUT POWER switch.

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SECTION 10

RS-232 SERIAL REMOTE INTERFACE OPTION

10 RS-232 SERIAL REMOTE INTERFACE OPTION

This section describes using the optional RS-232 (Serial) REMOTE interface of the UPC. This section is intended to be used in conjunction with section 5 of this Operation Manual.

10.1 GENERAL

The RS-232 REMOTE interface of the UPC is intended to replace the IEEE-488 (GPIB) interface as an option in the UPC. See section 10.3 for installation information.

10.2 SPECIFICATIONS

The RS-232 REMOTE interface of the UPC is compatible with the ANSI/IEEE-488.2, SCPI and RS-232C standards. It loosely adheres to the RS-232C standard as some interfacing requirements of that standard are not necessary.

This REMOTE interface of the UPC has the following communication characteristics:

1. Selectable **BAUD RATES** of

   38.4 kBAUD
   19.2 kBAUD (default)
   9600 BAUD
   4800 BAUD
   2400 BAUD
   1200 BAUD
   300 BAUD

2. Selectable **PARITY** of ODD, EVEN or NONE (default).

3. Selectable **EOS** (End Of String) Terminator CR, LF or CR/LF (default).
   This selects the EOS transmitted from the UPC. The UPC automatically accepts any of the above combinations when receiving.

4. 8 Data bits, 1 Start bit, 1 Stop bit.

5. HARDWIRE HANDSHAKE only, (X-ON/X-OFF not available).

This REMOTE interface of the UPC has the following Handshake characteristics:

A. Operation is HALF-DUPLEX (per IEEE-488.2).
B. The UPC operates as a DCE.
C. DTR from the HOST (DTE) is ignored.
D. DSR and DCD from the UPC is maintained in a TRUE state.
E. CTS from the UPC is used to signal the HOST that the HOST may send data.
F. RTS from the HOST is used to signal the UPC that the UPC may send data.

Refer to section 10.6 below for Pinouts and Signal names.

10.3 INSTALLATION

Installation of the RS-232 interface is generally performed at the factory. This involves removing the IEEE-488 interface PCB assembly and rear panel connector/cable and installing the RS-232 interface assembly and rear panel connector/cable.

INTERFACE PCB DIP Switch S1-5 must be set to ON to indicate that the RS-232 interface has been installed.

10.4 SETUP

After installing RS-232 interface into the UPC (or after ERASING ALL PROGRAM MEMORY), the RS-232 communication parameters must be set (BAUD RATE, PARITY and EOS Terminator). Do this through the following steps.

1. Press the fn key, select **GENERAL SETUP** then **UPC STATUS**.

2. Press the EDIT key and enter the desired **BAUD RATE** numerically, selected from the list above. Then press **ENTER**.

3. Select the **PARITY** by pressing the +/- key until the desired selection (NONE, ODD or EVEN) is shown. Then press **ENTER**.

4. Select **EOS** (End Of String) Terminator by pressing the +/- key until the desired selection (CR/LF, LF or CR) is shown. Then press **ENTER**.

4. Press **STORE**.

NOTE: Incorrect communication parameters may result in the UPC displaying a
PARITY ERROR,
FRAMING ERROR, and/or
OVERRUN ERROR.

Sending a BREAK signal will result in a BREAK RCVD message and will terminate data transmission in progress from the UPC.

10.5 OPERATION

Operation of the UPC via RS-232 REMOTE interface consists of utilizing the same commands available for the IEEE-488 interface (see UPC MANUAL sect. 5) except as noted below.

NOTE: Normally the UPC is in the LISTENER mode. When the UPC is Queried for information, the UPC automatically enters the Talker mode until the response data is sent or another command is sent from the Host.

10.5.1 COMMUNICATION MONITORING AID

The UPC STATUS Display (fn,3,3) displays "LISTENER" while data is being received from the HOST, or "TALKER" if a Query response (Message AVailable) is available and has not yet been completely sent by the UPC.

The UPC STATUS Display will display the LAST DATA BYTE received from the HOST. Carriage Returns are displayed as Line Feeds (0Dhex shown as 0Ahex).

The UPC STATUS Display also will display "RTS" if the Request To Send signal from the HOST is true. This signal must be true to allow the UPC to send data. To monitor CTS (Clear To Send) from the UPC, use the Host or a probe at the Host end of the Serial Interface cable. The Host must not send commands or data unless CTS is true.

This monitoring aid is not updated as fast as serial communications can occur, therefore sudden changes on the Serial Interface may not be seen on the UPC display.

10.5.2 FUNCTIONAL EXCEPTIONS

Some functions applicable with the IEEE-488 interface are **NOT** applicable with the RS-232 interface. Specifically they are the following:

1. All IEEE-488.1 interface functions
   (see UPC MANUAL sect. 5.6.1).

2. IEEE-488.2 commands: ***SRE** and ***SRE?**, (they are ignored)
   as Service Requests and Serial Polls are not applicable.
   (see UPC MANUAL sect. 5.5.3.1).
   (Use ***STB?** to obtain the Status Byte.)

10.5.3 FUNCTIONAL ADDITIONS

The following commands have been added to replace functions lost due to the removal of the IEEE-488.1 GPIB. These commands are similar to the IEEE-488.2 Common Commands and fall into the category of DEVICE CONTROL COMMANDS (see section 5.6.2 of the UPC Manual).

***DCL** DEVICE CLEAR - Causes a Hardware reset of the UPC.

***LLO** LOCAL LOCKOUT - Puts the UPC into REMOTE with LOCAL LOCKOUT state.

***GTL** GOTO LOCAL - Restores LOCAL mode.

10.6 PHYSICAL CONNECTIONS

Connection to the UPC RS-232 interface is made via a DB-25 connector on the rear panel of the UPC SCU or POWER SOURCE. This connector replaces the GPIB (IEEE-488) connector.

UPC Pinouts are as follows: (Directly connects to IBM-PC DB-25)

PIN 1 - CHASSIS GROUND

PIN 2 - TRANSMIT DATA (from HOST to UPC)

PIN 3 - RECEIVE DATA (from UPC to HOST)

*PIN 4 - RTS, Request to Send (from HOST to UPC)

*PIN 5 - CTS, Clear to Send (from UPC to HOST)

PIN 6 - DSR, Data Set Ready (from UPC to HOST)

PIN 7 - SIGNAL GROUND

PIN 8 - DCD, Data Carrier Detect (from UPC to HOST)

PIN 20 - DTR, Data Terminal Ready (from HOST to UPC)

All other pins are reserved for future use.

*PINS are used for HANDSHAKING. See section 10.2 (item 4) above.

Pinouts for IBM-PC DB-9 are listed below for reference.

PIN 3 - TRANSMIT DATA (from HOST to UPC)

PIN 2 - RECEIVE DATA (from UPC to HOST)

*PIN 7 - RTS, Request to Send (from HOST to UPC)

*PIN 8 - CTS, Clear to Send (from UPC to HOST)

PIN 6 - DSR, Data Set Ready (from UPC to HOST)

PIN 5 - SIGNAL GROUND

PIN 1 - DCD, Data Carrier Detect (from UPC to HOST)

PIN 4 - DTR, Data Terminal Ready (from HOST to UPC)

TESTING THE RS-232 REMOTE INTERFACE for the PACIFIC POWER SOURCE UPC

1. Connect the UPC RS-232 serial interface to a DTE serial port of a PC using a DB-25 cable. Most 25 pin connectors on PC's are DTE type. The UPC is a DCE type and must connect to a DTE port. If using a 9 pin connector on the PC, verify the pinouts of the cable match the UPC to the PC correctly.

2. Configure the PC Baud Rate to 19.2 or 9.6 kBaud, No Parity, 8 Data bits, 1 stop, 1 start bit using a terminal emulation program. Ensure the UPC is configured the same (see section 10.4 of this manual for setup). Leave the EOS set to CR/LF.

3. Enter the UPC STATUS display of the UPC (fn,3,3), do NOT press EDIT this time. See section 5.1 of the Manual Insert for info on the **COMMUNICATION MONITORING AID**. Verify that "RTS" is displayed on the UPC STATUS display.

4. Send Executable commands from the PC such as SYST:BEEP, VOLTS 100, FREQ 50, and verify the UPC responds correctly.

5. Send Query commands from the PC such as *IDN?, FETCH:VOLT1?, and verify that the PC receives correct data from the UPC after each Query command is sent. No other operation is needed to cause the UPC to send the response data.

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MODIFICATIONS

This section is reserved for any modifications that may be made.

MP MASTER
MA21694